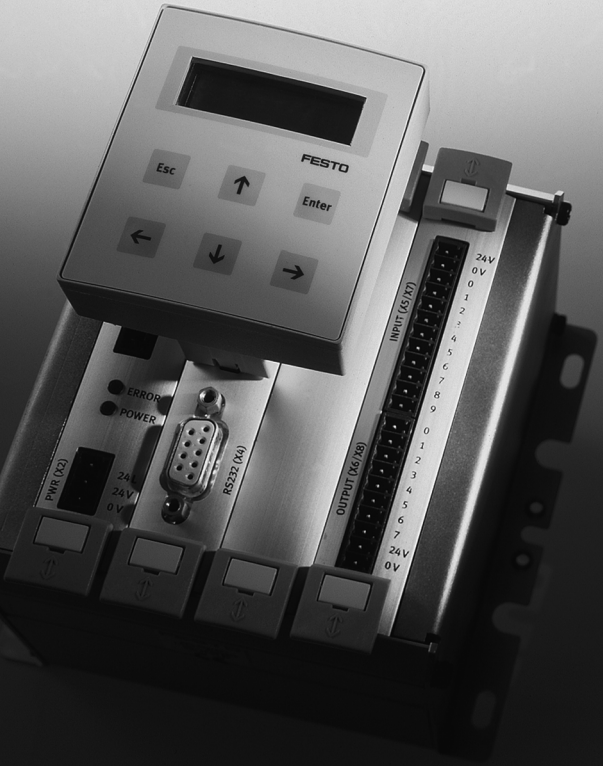
Smart Positioning Controller SPC200



FESTO

Software package WinPISA

Version 4.51

Programming, Commissioning and Service for pneumatic and electric Axes

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Designated use

With this manual and the appropriate software, the user who is familiar with positioning systems, can program and commission single and multi-axis applications with the SPC200 Smart Positioning Controller.

The software package consists of the WinPISA program and an extensive help system.

WinPISA stands for the programming, commissioning and service for pneumatic and electric axes under Microsoft Windows).

The user programs are generated in accordance with the specifications of DIN 66025.

WinPISA can be completely removed from computers, on which it is no no longer required, using an uninstall program.

The SPC200 and the peripherals which can be connected to it are documented in their own manuals. The safety information and description of intended use given in these manuals MUST be followed.

Please observe the standards specified in the individual chapters, as well as local and national laws and regulations.

Safety instructions

When commissioning and programming positioning systems with WinPISA, you must at all costs observe the safety regulations listed in the system manual for the SPC200 as well as in the operating instructions for the other components used.

The user must make sure that nobody is in the operating range of the connected actuators or axis system. The area of possible danger must be protected using suitable measures such as barriers or warning signs.

Warning
Pneumatic and electric axes move with great force and at high speed.

Collisions can lead to serious injury or to damaged components.

Make sure that nobody can place his/her hand in the operating range of the connected actuators or axes when the system is connected to a source of power (i.e. compressed air, supply voltage).

Warning
Faults in parametrizing can cause injury to human beings and damage to property if the controller is enabled with a 1-signal at the ENABLE input.

Enable the controller only if the axis system is correctly installed and parametrized.

Warning
If the tubing of your axis system has been incorrectly connected and you enable the controller, the drive will move at high speed and high acceleration into an end position, depending on the value of the supply pressure (control direction swapped). This can lead to serious injury and damage to components.

Always check the tubing before enabling the controller with a 1-signal at the ENABLE input.

Checking that a program contains no syntactical errors is no guarantee of error-free operation. When commissioning positioning systems the user must therefore reckon with sudden uncontrolled movements of the axes.

Target group

This manual is directed exclusively at technicians who are trained in control and automation technology and who have experience in installing, commissioning and diagnosing programmable logic controllers (PLC), positioning systems and field bus systems.

Service

If you have any technical problems, please contact your local Festo Service.

Important user instructions

Danger categories

This manual contains notes on possible dangers which may occur if the product is not used correctly. These notes are marked (warning, caution, etc.), printed on a shaded background and also accompanied by a pictogram. A distinction is made between the following types of danger instructions:

Warning
This means that serious injury to persons or damage to property can occur if these instructions are not observed.

Caution
This means that injury to persons or damage to property can occur if these instructions are not observed.

Please note
This means that damage to property can occur if these instructions are not observed.

In addition, the following pictogram indicates passages in the text which describe activities with electrostatically vulnerable components:

Electrostatically vulnerable components: incorrect handling can cause damage to components.

Marking special information

The following pictograms mark passages in the text containing special information.

Pictograms

Information:
Recommendations, tips and references to other sources of information.

Accessories:
Details about necessary or useful accessories for the Festo product.

Environment:
Information on the environmental-friendly use of Festo products.

Text markings

- The bullet marks activities which may be carried out in any desired order.

1. Numbers indicate activities which must be carried out in the sequence stated.

– Hyphens indicate general items.

Current information on WinPISA

Please note
Observe the current information in the file README.TXT in the subdirectory \BIN of the WinPISA installation directory.

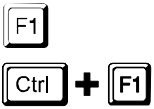
This manual contains the information necessary for operating WinPISA version 4.5x (4.51 or 4.5).
WinPISA version 4.51 is downwards-compatible and supports all SPC200 Smart Positioning Controllers with operating systems as from version 3.8x. Some correspondingly marked functions are only available as from operating system version 4.93, 4.90, 4.82 or 4.63.

Information on operating system version 4.82 can be found in the system manual for the SPC200 type P.BE-SPC200-... .

Please note
Projects and files created with WinPISA version 4.51 can also be processed with earlier WinPISA versions. The following restrictions apply:

- With WinPISA 4.5: Project contains no settings for error messages via fieldbus and for behaviour at stop.
- With WinPISA 4.41: Project contains no DeviceNet2 fieldbus module (none of the revisions in Operation System Version 4.90 not contained in Version 4.82 are supported),
- with WinPISA 4.31: Project contains no extended NC syntax and no standard cylinder type DNCI-... (all modifications to operating system version 4.82 compared with version 4.63 will not be supported),
- with WinPISA 4.1a: Project contains no new NC commands or extended NC syntax, no standard cylinder type DNCI-... and no swivel module type DSMI-... (all modifications to operating system version 4.82 compared with version 4.63 will not be supported).

Commissioning for pneumatic axes and controllers of the SPC200 is described via I/Os. Information on electric axes and field bus modules can be found in the specific manuals (see section “Documentation on the Smart Positioning Controller SPC200”).



You can access the online help any time in WinPISA by pressing function key F1. With key combination CTRL + F1 you can access directly a context-related help page, providing this is available. You will also find a “Help” button in many dialogue windows.

Contents of the software package

The software package consists of:

- one CD ROM,
- the licence agreement,
- this manual.

PC requirements

The following are required for commissioning:

- Pentium-compatible PC with:
- Operating system as from Windows 98,
- RAM corresponding to the recommendations for the Windows version,
- 30MB of available hard-disk space,
- CD-ROM drive,
- a free serial interface to connect the positioning system (for online mode only).

Conventions

	Various parts of the program are identified in this manual by the way in which they are written.
[File] [New ...]	Menu entries are framed in square brackets, e.g. the command [New project ...] opens a new project in the menu [File].
“Cancel”	Names of windows, dialogue windows and buttons, e.g. “Message window”, “Determine project file”, “Cancel” as well as designations e.g. “DGPL-PPV-A-KF-B” are represented in inverted commas.
`N010 G00 X250`	Programming examples are marked in a different print type, e.g. “`N010 G00 X250`”.
CTRL	Names of keys on the PC keyboard are represented in upper case letters in the text. (e.g. ENTER, CTRL, C, F1, etc.).
CTRL + C	Some functions require two keys to be pressed simultaneously. Hold e.g. the CTRL key pressed down and press the C key as well. This is written in the text as CTRL+C.
	The left mouse button is always meant if the manual refers to “clicking” or “double-clicking”. If the right-hand mouse button is to be used, this will be mentioned in the text.
	Many functions in WinPISA can be executed by clicking on a button in the toolbar. This button will be shown adjacent to the text (e.g. the “Online mode on” button).
	A few actions depend on the symbol selected in the project window. This symbol will be shown adjacent to the text (e.g. the Hardware symbol).

Product-specific terms and abbreviations

The following product-specific abbreviations are used in this manual:

Term/abbreviation	Meaning
0-signal	Input or output supplies 0 V
1-signal	Input or output supplies 24 V
Application parameters	Configuration data which describe the conditions of use specified by the application.
Axis parameters	Configuration data which describe the structure, the properties and the components of the axis used.
Axis interface	The measuring system and the proportional directional control valve are connected to the SPC200 via the axis interface.
Axis interface string	Total number of modules and cables which are connected to an axis interface connection of the SPC200.
CP cable	Special cable for coupling the various modules on the axis interface string.
F	Flag (F)
I	Digital input
I/O modules	Common term for the modules which provide digital inputs and outputs on the axis interface string.
I/Os	Digital inputs and outputs
Modules	Function cards which can be plugged into the rack of the SPC200.
PLC/IPC	Programmable logic controller/industrial PC
Q	Digital output
R	Register
String	Total number of modules which are connected to an axis interface string.

Documentation on the SPC200 Smart Positioning Controller

This manual contains general basic information on commissioning, programming and diagnosing the SPC200 with the WinPISA software package.

Extension modules are available for coupling to field bus systems and electric axes. Special information on this can be found in the manual for the relevant module.

Information on the functioning, fitting, installation and commissioning of pneumatic axes with the SPC200 can be found in the system manual for the SPC200.

Type	Title	Contents
System manual	SPC200 Smart Positioning Controller, user manual type P.BE-SPC200-...	Installing, commissioning and diagnosing pneumatic axes with the SPC200; standard components and modules
Software manual	Software package WinPISA type P.SW-WIN-PISA-...	Functions of the WinPISA software package
Help system	Help system for WinPISA (contained in WinPISA)	WinPISA help system
Manuals	Field bus module type P.BE-SPC200-...-...	Installing, commissioning and diagnosing the relevant field bus module
	Stepping motor module type P.BE-SPC200-SMX-1-...	Installing, commissioning and diagnosing with a stepping motor

Information on the pneumatic components can be found in the operating instructions supplied with the product.

Information on operating system versions of the SPC200 and on software versions of WinPISA

The following operating system versions are supported by this manual:

Operating system	Validity date	Relevant WinPISA	Validity date
Version 3.8	08-2001	Version 4.1	05-2001
		Version 4.1a	06-2002
Version 4.63	10-2003	Version 4.31	10-2003
Version 4.82	12-2004	Version 4.41	12-2004
Version 4.90	03-2006	Version 4.5	03-2006
Version 4.93	11-2008	Version 4.51	11-2008

Please note
The operating system version and the WinPISA versions are always downwards-compatible, i.e. a new version supports the performance of the older versions.

Conversely the following applies: In each case the older version does not support the extended and new performances of the newer versions.

Caution
The functionality of the MMI (control panel) has been frozen at the operating system status version 3.8. This means that all new functions as from operating system version 4.63 and earlier are no longer supported by MMI.

If the MMI is used for commissioning and with operating system version 4.63 and earlier, the switching cycle of the ENABLE signal must be maintained during the movement test, see System Manual for the SPC200.

This modification serves exclusively for increasing safety for people as well as for the machine during commissioning.

Marking version-related information

Text passages which contain special information on certain operating system versions are usually marked as follows:

New feature
as from **OS 4.63**

New feature:
Note that the the function marked is new as from the specified operating system version (in the example **4.63**) and is not supported by the older operating system versions.

Compatibility violation
as from **OS 4.63**

Compatibility violation:
Note that as from the specified operating system version (in the example **4.63**), the function marked is not compatible with the older versions. The explanations in the text must be observed.

Overview of operating system versions

The following table provides an overview of the modifications to the operating system (firmware) of the SPC200:

Version	Identification	What has been changed?	See section
up to 3.8	–	– WinPISA version 4.1a is recommended for this version. – Supported drives of the DGP family and stepping motors of the MTR-VRDM family. – With regard to the system functionality, this version is the reference for all new versions.	–

Version	Identification	What has been changed?	See section
as from 4.63	New feature as from **OS 4.63**	– At least WinPISA 4.31 is recommended for this version. – The piston-rod drives of the DNC/DNCM family and the rotary drives type DSMI are supported. – The new stepping motor controller type SEC-ST is supported. The stepping motor card must have software version 1.42. – The performances of the PROFIBUS card as from software version 2.0 are supported. – The field bus card for DeviceNet version 1.2 is supported. – Command M39 is introduced. With this command, a valve positioning value and therefore a certain flow of the proportional valve can be specified directly. – Commands M40 and M41 are introduced. These two commands enable movement limitvalues with command M39 to be defined. – The positioning commands G01, G02, G08, G09 and G25 can also fetch their parameters from the position registers @. – The positioning commands G01, G02 can also fetch the parameters for the proportional speed from the registers Rn. – Command G25 X[Y,Z,U] 0 receives the meaning 0 % – instead of 100 % – and causes the next program line to be processed immediately when the positioning command following command G25 is started. – M10 without parameter activates the specifications from the configuration list. – The axis status flags F64...F127 are introduced.	– System manual for the SPC200 Manual for the stepping motor indexer module Manual for the field bus module PROFIBUS or DeviceNet 5.4 5.4 5.4 5.4 5.4 5.4 5.3.6
	Compatibility violation as from **OS 4.63**	– Movement test: The course and the on-off switching sequence to be observed of the ENABLE signal has been modified. – A version check has been introduced. This prevents programs with new performances/functions from being unintentionally modified by older versions.	System manual for the SPC200 See Service Information/ Brief description supplied with the SPC200.

Version	Identification	What has been changed?	See section
as from 4.82	New feature as from **OS 4.82**	– At least WinPISA 4.41 is recommended for this version. – The DNCI drive family with incremental measuring system is supported. – Reference travel for pneumatic axes has been introduced ⟶ G74. – Channel 5 has been introduced in the configuration data for the digital nominal value specification via the field bus ⟶ M10. – Command M37 can be parametrized with values (mass value) from the position registers @n. – The “work item mass in the basic status” (the axis) has also been introduced in the configuration data. You can then define the mass load which is to be effective when the system is switched on. The dialogue for the axis identification travel has been adapted accordingly in WinPISA 4.41. – The commands M10 and M11 can be parametrized with values from the position registers @n. – “Serious fault” will no longer be generated if there is undervoltage in the load voltage. The exchange of data with the measuring system has been retained and the counter status of the incremental measuring system will continue to be updated, as long as the supply voltage is applied and providing there is no other “serious system fault.”	– System manual for the SPC200 5.4 5.4 5.4 System manual for the SPC200 5.4 –
as from 4.90	New feature as from **OS 4.90**	– At least WinPISA 4.50 is recommended for this version. – Support of fieldbus module type SPC200-COM-DN2 – System status flags F88 and F89 as status flags for Task A and B. – CP-I/O modules type CP..-CL are supported.	– Description of fieldbus module 5.3.6 –
as from 4.93	New feature as from **OS 4.93**	– At least WinPISA 4.51 is recommended for this version. – Error messages via the fieldbus can be suppressed through paramaterization (no stop of the PLC). – Stop behaviour can be configured.	– Description of fieldbus module 4.3.3

Guidelines

WinPISA permits various procedures for creating projects and for commissioning the SPC200. A large number of functions are available, the use of which is not absolutely necessary.

This section is intended as a guideline. It shows a logical procedure for generating and commissioning projects and indicates the functions required. It is assumed that your positioning system is correctly connected to the PC and is ready for operation.

Further information on commissioning the positioning system can be found in the manuals and descriptions for the SPC200 (see section “Documentation on positioning”).

Preparing the SPC200

Create the hardware configuration

Mount the components as described in the SPC200 manual.

In order to commission the axes, you must first create the desired configuration on the SPC200.

Preparing the PC

Start and configure WinPISA

(see also sections 1.1, 1.2 and 1.7)

1. Please observe the current information in the file README.TXT in subdirectory \BIN of the WinPISA installation directory.
2. Start WinPISA.

3. For communication with the SPC200, set the serial interface used and the desired baud rate under [Online] [Data transmission].
   When the SPC200 is connected, you can test the data transmission. To do this activate [Online] [Online mode]. The set values are correct unless an error message is shown here.

Step 1

Simulate the existing hardware configuration in a WinPISA project

(see also sections 1.7, 2.1, 2.2 and 4.2)

Read out hardware configuration of the SPC200 (recommendation)

1. Activate online mode (command [Online] [Online mode]).

If your hardware configuration differs from the saved nominal configuration, you will receive a fault message (00004001). Quit the fault message with “OK”.
The deviations are displayed in the dialogue window “Save actual as nominal configuration?”
Check to make sure that the configuration displayed is correct. If necessary, check to make sure that the status LEDs of all connected modules light up and that the modules are therefore recognized. With “Yes” you accept the actual configuration as the nominal configuration.
If the axis assignment has been modified, a message will be displayed stating that a data reset is necessary for this. If there are no data in the SPC200 which must first be saved in a WinPISA project, you can carry out the data reset with “Continue”.

When leaving the factory, the SPC200 is prepared for saving the current hardware configuration in the first startup phase automatically as the reference configuration (there is no error message).

2. Read out project (command [Online] [Upload] [Project]). Enter the project name and confirm. Enter the title and confirm.

Or set hardware configuration manually

1. Create project (command [File] [New project]) or open project (command [File] [Open project]).
2. Insert the SPC200 into the project. To do this, select the icon “Hardware” in the project window and the command [Insert object] in the menu [Edit]. Then select the entry “SPC200” and confirm.
3. Set the configuration of the SPC200. (Set the basic unit and modules correctly in the dialogue window “SPC200 configuration” and confirm the selection.)
4. Insert hardware (axis or I/O module). To do this, select the icon for the axis interface string or for the stepping motor interface in the project window and select the command [Insert object] in the menu [Edit]. Then select the desired entry “Positioning axis” or “I/O module”. Then select the axis used or the desired I/O module. Repeat this procedure for all the components.

Commissioning a pneumatic axis

Step 2

Set the axis-specific parameters and load the project into the SPC200 (pneumatic axis)

(see also section 4.3)

1. Set the axis and application parameters. To do this mark the icon by the desired axis in the project window and select the command [Configure] in the menu [Edit]. Now set the axis and application parameters correctly. You will find explanations on the individual parameters in the WinPISA help.

2. If necessary, set the axis and application parameters for further axes as described under 1.

Please note
Controller parameters are not usually modified.

3. If necessary, activate the online mode (command [Online], [Online mode]).
   If your hardware configuration differs from the saved reference Configuration, you will receive an error message (00004001). If the set configuration corresponds to the actual configuration, this will become the reference configuration when the project is loaded.

4. Load the project (command [Online] [Download] [Project]).

Step 3

Check the tubing (optional)

(see also section 4.4)

To do this carry out the movement test (the following description is valid for operating system V4.6).

1. Apply a 0-signal at the input ENABLE.
2. If necessary, activate the online mode (Command [Online] [Online mode]).
3. Select the command [Online] [Diagnosis] [Movement test ..-axis] for the desired axis.
4. Select the desired axis in the dialogue window “Movement test”.
5. Apply a 1-signal at the input ENABLE.
6. Carry out the movement test: Modify the valve voltage and check the direction of movement.
   A 0-signal at ENABLE will set the valve voltage to 5 V and interrupt the movement test (with fault message).
7. Conclude the movement test for the selected axis with “Exit”.
8. Apply a 0-signal at the input ENABLE.

Step 4

Only with pneumatic drives with incremental measuring system (e.g. type DNCI-...): Carry out reference travel

(see also section 4.5)

Reference travel must be carried out for commissioning (Menu [Online] [Commissioning] [Reference travel]).

Step 5

Carry out the static and, if necessary, the dynamic identification travel

(see also section 4.6)

Before identification:

1. Set the correct operating pressure (standard setting = 6 bar).
2. Apply a 1-signal to the inputs ENABLE and STOP. During the first commissioning, a rising edge is required at the ENABLE input to enable the controller.
3. If necessary, activate the online mode (command [Online] [Online mode]).
4. Only with pneumatic drives with incremental measuring system (e.g. type DNCI-...):
   Reference travel must be carried out before identification travel (see step 4).

Carry out the identification:

1. Select the command [Online] [Commissioning] [Identification]).
2. Select the desired axis and the desired type of identific. (dynamic/static) in the dialogue window “Identification”.

Warning
With identification, an axis is set in motion with the highest acceleration and at the highest speed.
Make sure that:
– the complete positioning range of the axis is free
– the correct axis and application parameters are set.

3. Start the identification with the button “Start”.

The identification requires a certain amount of time.

Step 6

Calibrate the measuring system (optional)

(see also section 4.7)

If necessary, calibrate the measuring system.

Step 7

Move the axis manually (optional)

(see also section 4.8)

Check the functionability of the controller and the effectiveness of the software end positions.

Step 8

Enter the test program

(see also section 4.9 and chapter 5)

1. Create the program and open it. To do this, mark the software icon and select the command [Insert object] in the menu [Edit].
   Enter program number (0), the title and, if applicable, a description of the program in the dialogue window “New program”. Confirm the entry.
   Or open the existing program.

2. Enter the program in the program window, e.g.:

```
N000 G01 X50 FX50      ;Adapt pos. 50
N001 G01 X200 FX50     ;Adapt position 200
N002 M30               ;Program end
```

3. Carry out a syntax check if required (command [Compile] [Syntax check]).

4. Load the program into the SPC200 (command [Online] [Download] [Programs], select the program, confirm with “OK”).

Step 9

Setting the operating mode and start programs

(see also section 4.10)

1. If necessary, activate the online mode (command [Online] [Online mode]).

2. Mark the icon “SPC200-..” in the project window and open the dialogue window “SPC200 configuration” (command [Edit] [Configure]).

3. Set the operating mode and the start programs in the tab card “Operating mode/Start programs”.

Recommendation (for first commissioning):

- Determine the test program entered as start program A. Deactivate start program B (Startpr. B=***).

- Set the operating mode Start/Stop. Programs can then be controlled independently of a higher-order PLC/IPC e.g. with the control panel (easier test possibilities).

4. Load the settings into the SPC200 with “Download”.

5. Accept the settings with “OK”. Save any modifications to the project (with active project window, command [File] [Save]).

Step 10

Test the program in Debug mode or in continuous run

(see also sections 4.11 and 6.5)

Requirements:

– The program must be in the program memory.

– The axis and application parameters must be set and the project loaded into the SPC200.

– The operating mode Start/Stop and the start program must be set.

– There must be a 1-signal at ENABLE and STOP.

Test the program in Debug mode

• Test the program with the Debug mode in WinPISA (command [Online] [Control axes] or with the control panel (command SINGLE STEP, menu TEST/DIAG).

Start the program

• Start the program with a rising edge at the START input or with the control panel (menu SYSTEM CONTROL, command START SYSTEM).

Step 11

Create a position list and loading it into the position register

(see also sections 5.1 and 5.7)

1. Target positions can be saved in a position register in the SPC200. These positions must first be entered in the position list. Open the position list by selecting the icon in the project window and pressing the ENTER key.

2. Enter a symbolic identifier (a position name) for the positions required in the position list (this name can later be used directly in your user programs to identify the position concerned). You can then enter the coordinate values of the position in the columns for the appropriate axis.

3. You can use [Edit] [Teach position] in Online mode to teach positions in the position list directly using the axis concerned (approach and accept).

4. Save the position list ([File] [Save] with an active position list window). Then load the position list with [Online] [Download] [Position list] into the position register of the SPC200.

Step 12

Optimize the positioning behaviour (optional)

(see also sections 4.3, 6.5, 6.6 and 6.7)

1. Remember to carry out identification travel again after replacing system components, after modifying the axis or application parameters or the system structure. Characteristic values of your system will be ascertained during the system identification.

2. Check the axis, application and controller parameters.

3. Due to the high dynamics of the system, it is often difficult to judge exactly the positioning behaviour by observation. WinPISA offers support in evaluating by registering the measured values and by graphic functions. In this way, you can record measured values, e.g. nominal value, actual value, speed, etc. and display them on the screen. A more exact judgement can be made by comparison of measurements with different settings.

4. When optimizing, check the controller parameters “gain factor” and “damping factor”.

5. Adaption takes a certain amount of time. Let your user program run through a few cycles before you modify the controller parameters again.

Installation and general user information

Chapter 1

Contents

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Contents of this chapter

This chapter provides a summary of the components and of the functioning of the WinPISA software package. It contains basic information on:

- the installation and deinstallation of the software package
- setting up the directory paths
- general operating
- the help system
- the online mode for communicating with the SPC200.

Further information

Please observe the current information in the file INFO.TXT on the installation data carrier as well as in the file README.TXT in the subdirectory \BIN of the installation directory of WinPISA.

1.1 The WinPISA software package

The WinPISA software package offers support in commissioning and servicing pneumatic and electric axes with the SPC200. The following program components are included in delivery:

– WinPISA

– Help system

– Uninstall program

Fig. 1/1: WinPISA

You can carry out the following tasks using individual WinPISA program components:

WinPISA	– Easy management of different positioning drives in projects – Programming of positioning systems – Commissioning and diagnosis of positioning drives in Online mode – Graphic representation of measurements for the optimization of positioning systems
Help system	– Information on the operation of WinPISA.
Uninstall program	– Remove individual modules from the hard disk of your computer.

1.2 Setting up the software

The WinPISA software package can be installed on your PC in accordance with your requirements. You can:

– install WinPISA in the desired language,

– deinstall WinPISA.

1.2.1 Installing WinPISA

Please note
A lot of computer viruses are transferred automatically to diskettes during every read and write process.

Before installing diskettes, make sure therefore that they have write-protection.

In order to install the software modules of WinPISA on your hard disc, proceed as follows:

1. First start up Microsoft Windows.
2. Place the WinPISA installation CD in the appropriate drive.
3. Select the command [Run] in the menu [File] of the program manager or in the start menu.
4. Enter the drive identification and the name of the installation program (e.g. D:\SETUP.EXE) in the dialogue window “Run”.
5. Start the installation program with “OK”.

Selecting the language

In the first step of the installation program, select the language in which you wish to install WinPISA.

In order to install the English version of WinPISA, select the option “English” in the list box “Select language”. If desired, you can select one of the other languages available in this list.

Confirm the language choice with “→”.

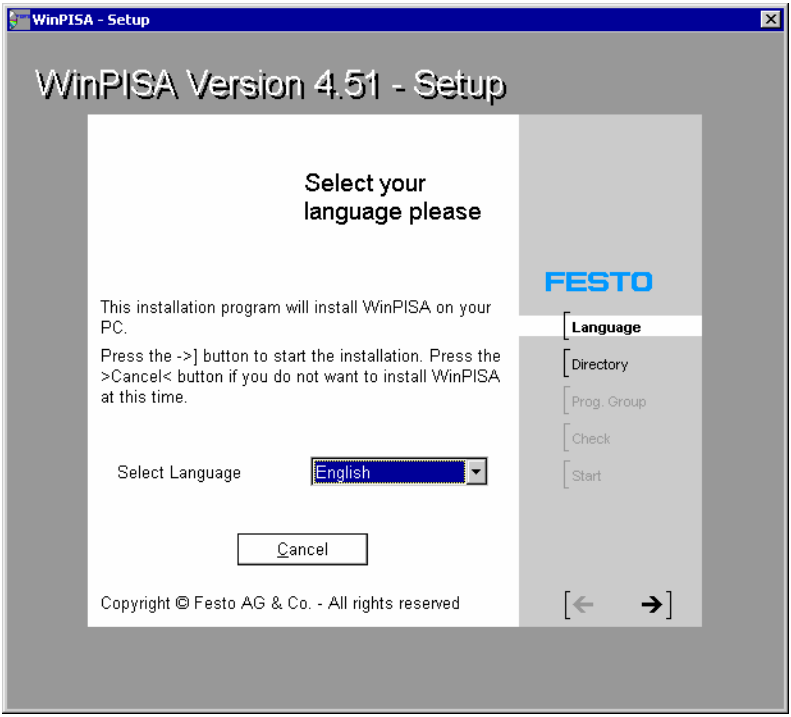

WinPISA - Setup
WinPISA Version 4.51 - Setup
Select your language please
This installation program will install WinPISA on your PC.
Press the ->] button to start the installation. Press the >Cancel< button if you do not want to install WinPISA at this time.
Select Language
English
Cancel
Copyright © Festo AG & Co. - All rights reserved
FESTO
Language
Directory
Prog. Group
Check
Start

Fig. 1/2: WinPISA installation – language selection

Selecting the directory

Select the installation directory as the next step.

Enter a different path in the “Install to” field or select another directory using the button next to the field if you do not wish to accept the default “C:\FESTO\WINPISA”.

Accept the installation directory with “→”.

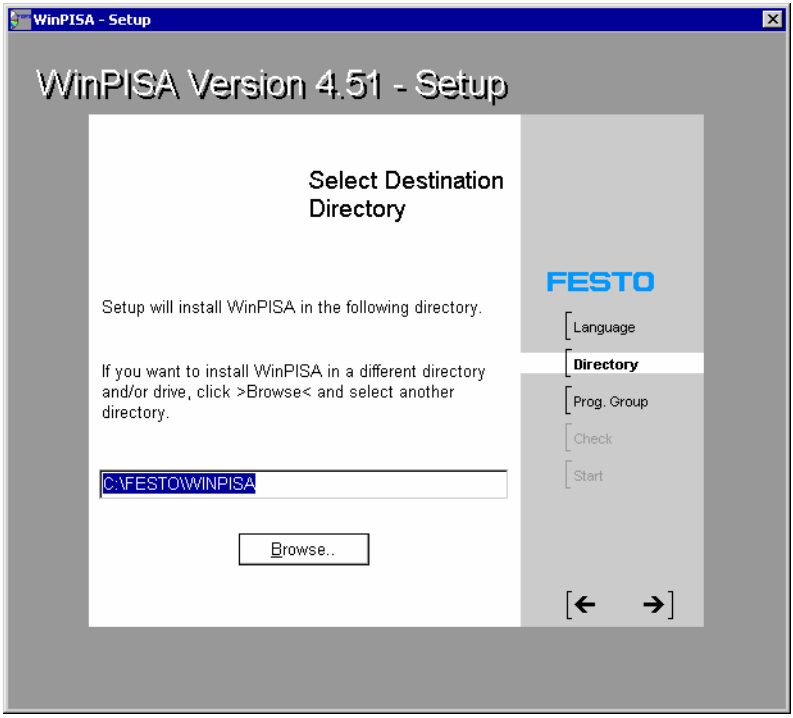


Fig. 1/3: WinPISA installation – directory selection

Selecting the Program Group

As the next step select the program group in which WinPISA should be installed.

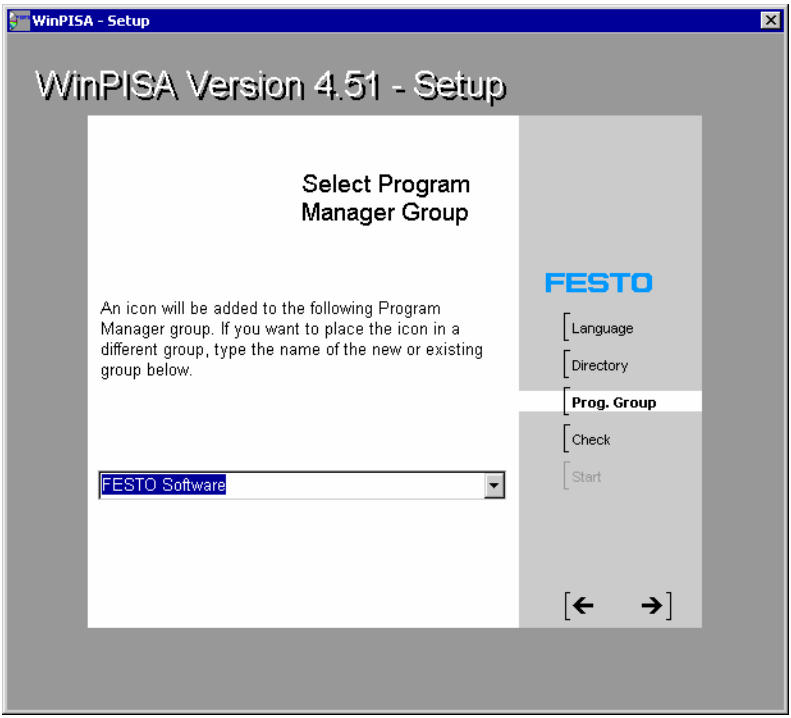

WinPISA - Setup
WinPISA Version 4.51 - Setup
Select Program Manager Group
An icon will be added to the following Program Manager group. If you want to place the icon in a different group, type the name of the new or existing group below.
FESTO Software
FESTO
Language
Directory
Prog. Group
Check
Start

Fig. 1/4: WinPISA installation – program group selection

Select a group from the list box, or enter the name of a new group, if you wish to install WinPISA in a different Program Group.

Accept the program group with "→".

Checking and starting the installation

For “Checking”, you can check the steps carried out so far with “←“ and “→“ and, if necessary, modify them. Then start the installation with “Start”.

Now start installation using “Start”.

The WinPISA files will now be copied to the hard disk and decompressed. The progress of the installation is shown on a percentage bar.

Confirm the message “The WinPISA Version installation is complete” with “OK”.

When WinPISA has been successfully installed, you will find the individual program components of WinPISA in the start menu under [Festo Software].

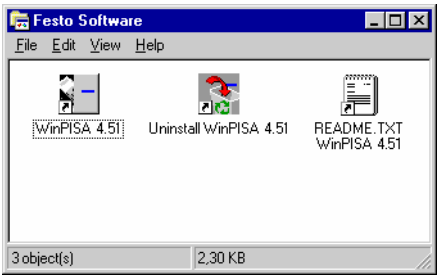


Fig. 1/5: WinPISA program group

1.2.2 Deinstalling WinPISA

With the deinstallation program of the WinPISA software package you can completely remove from your hard disk software modules which are no longer required.

With automatic deinstallation, all the files copied during installation will be removed and modifications to the configuration files will be cancelled.

Files created by the user, e.g. projects or systems planned in the project planning tool, will not be deleted.

Individual settings in the software, e.g. the interface and baud rate for the exchange of data with the SPC200, will be lost during deinstallation and must be recreated after a new installation.

Finish WinPISA, before you start the deinstallation.

Deinstall WinPISA as follows:

1. Start the program “Uninstall WinPISA” in the WinPISA program group.
   When you have deleted the program symbol or if you cannot find it, you can start the program “UNSETUP.EXE” in the sub-directory “BIN” of the WinPISA installation directory.

2. The deinstallation program will be started.
   Start the deinstallation with “Start”. You can exit the deinstallation with “Cancel”, without deinstalling WinPISA.

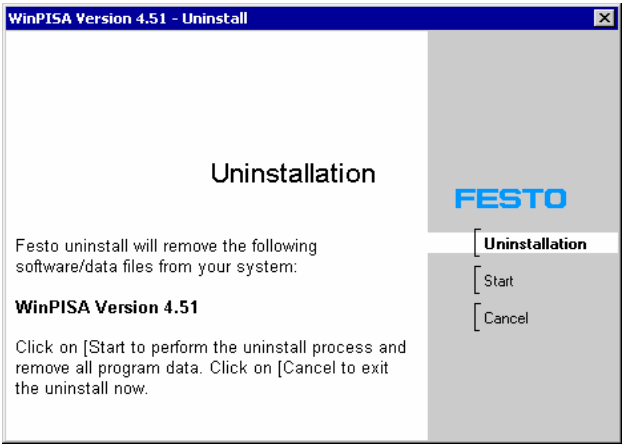

WinPISA Version 4.51 - Uninstall
Uninstallation
Festo uninstall will remove the following software/data files from your system:
WinPISA Version 4.51
Click on [Start to perform the uninstall process and remove all program data. Click on [Cancel to exit the uninstall now.
FESTO
Uninstallation
Start
Cancel

Fig. 1/6: Uninstall program

The course of deinstallation will be shown in a window.

When deinstallation is finished, check to see which files or directories have not been deleted by the deinstallation program.

1.3 Starting WinPISA

To start WinPISA:

1. First of all start Microsoft Windows.
2. Start WinPISA in the program group which you have specified during installation. Select the WinPISA symbol and press the ENTER key.

After a few seconds, the WinPISA application window will appear on your screen:

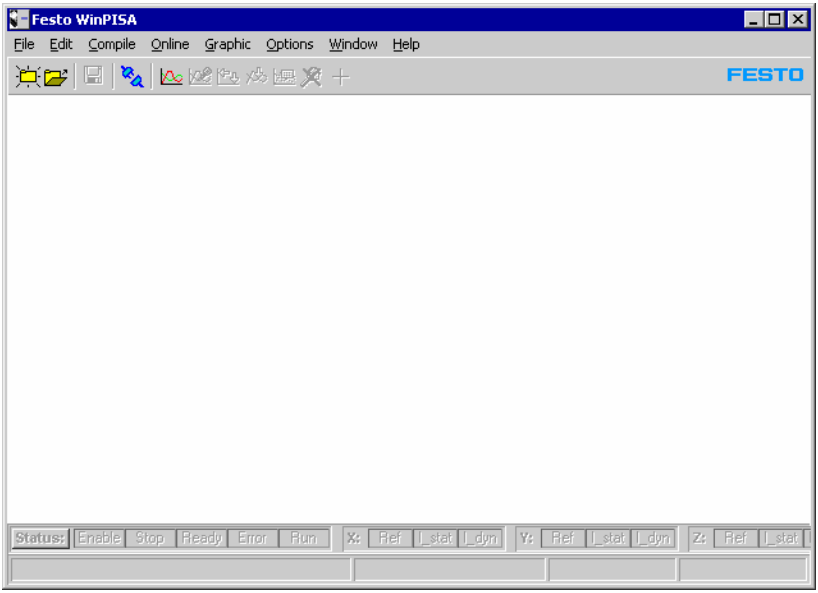


Fig. 1/7: The WinPISA desktop user interface

1.4 Setting options for WinPISA

Settings for project and editor windows

You can set the reaction of WinPISA for the project and the editor windows individually. To do this select the command [Settings] in the menu [Options] and activate the desired check box.

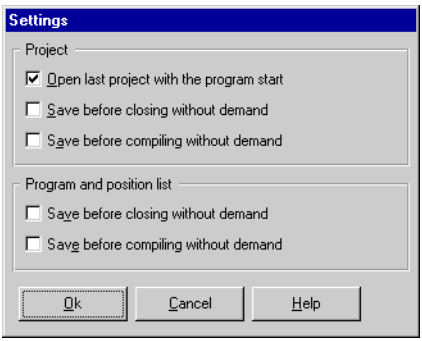


Fig. 1/8: Settings for project and editor windows

Setting the directories

WinPISA offers you the possibility of setting various directory paths (folders) as a presetting for storing projects (see chapter 2), Planned axis specifications (*.pta, see chapter 3) and measured data (see chapter 6).

You can set the directory paths as follows:

1. Select the command [Directories] in the menu [Options].

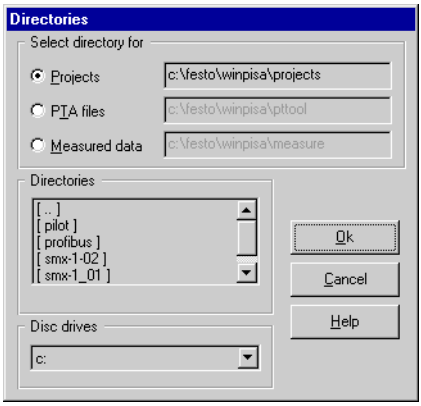


Fig. 1/9: Setting the directories

2. Select the directory path you wish to set under “Select directory for” in the dialogue window “Directories”. The valid path will be shown after the appropriate option.

3. Set the desired path under “Directories” or under “Disc drives”. The path set will be shown under “Select directory for”.

4. Repeat, where applicable, steps 2 and 3 for further directory paths.

5. Transfer the settings with “OK”.

The directories set are offered as presettings in the appropriate dialogue windows for selecting files.

1.5 General user information

The WinPISA software package is an application for the Windows operating system.

As such, its operation and the program user interface conform to the usual Windows standard. The buttons, menu bar, scroll bars, etc. behave in WinPISA exactly as in most other programs under Windows®.

1.5.1 Working with Windows applications

The most important actions and operating elements, as well as a few language conventions, will be described below. Please refer to your Windows Manual for further information on operations.

Windows elements

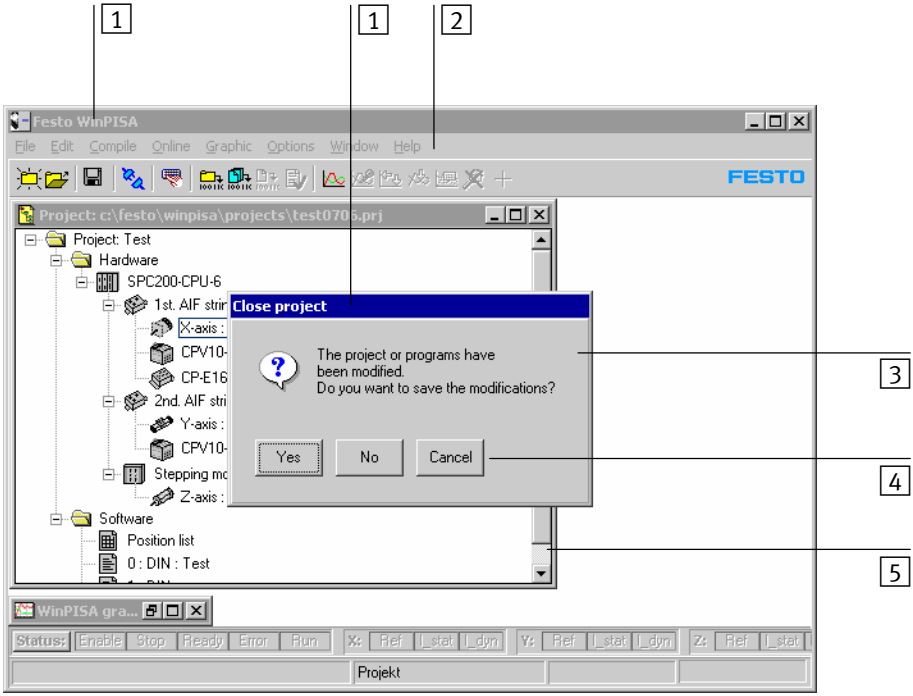
Application window

Windows applications are usually run in a window. This means that several programs can be run concurrently, each having its own window on the screen.

The application window occupies the whole screen in the next figure. It is displayed in full-screen state.

Title bar

Under Windows, each window has a title which is shown in the title bar. In the case of program windows, this is the program name (e.g. WinPISA), in the case of dialogue windows, it is the designation of the relevant dialogue.



1 Title bar

2 Menu bar

3 Message window

4 Command buttons

5 Scroll bars

Fig. 1/10: Windows application window

Generally, title bars have the system menu field on the left-hand side, and you can use these to open the system menu belonging to that window.

With the buttons “Minimize”, “Maximize” and “Restore” you can reduce the window to an icon or switch between full-screen and windowed representation.

Menu bar

Most actions are controlled by menu commands when you are working with applications under Microsoft Windows. The commands are grouped into individual menus. The menu can be opened by clicking with the mouse on the menu name. Alternatively, you can open a menu by pressing the ALT key and the identifying letter together. The identifying letter is underlined in the menu bar.

Menu commands

The commands in an open menu can be activated by clicking with the mouse. The identifying letter of the menu command (this letter is underlined) can also be pressed from the keyboard. You can also move the highlight to the command required using the arrow keys and then press ENTER.

There are 4 types of menu commands:

- Menu commands which directly carry out a certain action.
- Menu commands which open a dialogue window. These menu commands are identified by an ellipsis (three dots) after the command.
- Menu commands which open a cascading (overlapping) menu. These can be identified by a triangle to the right.
- Menu commands which can be checked. These correspond to a check box in their function. This menu item is activated and marked with a check mark when you select it.

Menu commands that are not available will be shown as dimmed text (generally grey).

Scroll bars

The size of most windows can be altered. The position of the scroll box in the scroll bar shows the approximate position of the content displayed relative to the complete content of the window. The content of the window can be moved using the scroll bars.

You can move the window content by clicking on the appropriate scroll arrow or by moving the scroll box to the desired position.

In the case of windows containing text, e.g. editor windows, the contents of the window will be automatically shifted when the insert cursor is moved.

Message box

The entries in the message boxes inform you, e.g. of the results of syntax checks and translations. They show errors or warn you of the effects of an activated command.

Command buttons

You can start an action using a button. For example, the “OK” button will confirm the content of the dialogue window. “Cancel” ends a process without incorporating the modifications.

Dialogue windows

Dialogue windows are used for entering data, selecting options, selecting entries from list boxes, etc.

When dialogue windows are open, no other element of the application window can be operated.

1 Tab card
2 Text box
3 Option button
4 Display field
5 Drop-down list box
6 List box
7 Check box

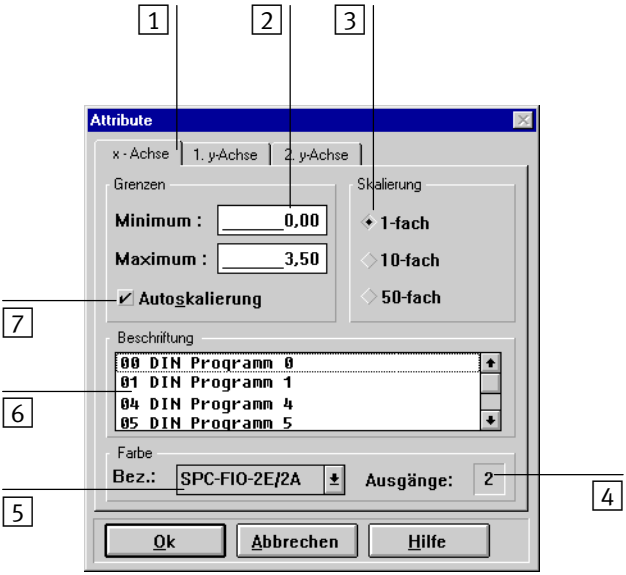


Fig. 1/11: Windows dialogue window (example)

Text boxes

Text boxes are the fields in dialogue windows in which you can enter information via the keyboard. You can therefore enter directly file names or program numbers. Entries are often limited to numbers or a certain number of characters.

Insertion point

The flashing vertical line shows the position of the insertion point. Text is added at this position in entry fields and editor windows.

When a text area is marked, it will be replaced by the new entry.

Display field

Information will be shown in display fields. Display fields cannot be edited.

List boxes

You can select an entry from a list in a list box. This can be e.g. a program name.

	In some list fields you can select several entries, e.g. when several programs are to be compiled. To do this, move the highlight over the entry desired or press the SHIFT key whilst moving the selection with the arrow keys. Non-consecutive entries can be selected by holding down the CTRL key and clicking on them with the mouse.
Tab cards	Tab cards break down the possible settings for a dialogue window into different areas, comparable to the index on a file. Dialogue windows with a lot of entry and setting possibilities then represented clearly, arranged according to theme.
Option buttons	Option buttons are grouped together in an option group from which only one option button (and therefore one possibility) can be selected. Option buttons are usually round or lozenge-shaped.
Check boxes	With check boxes you can select or reject any selection or setting. Control boxes are usually rectangular.

Working with the mouse

Windows programs support working with a mouse. The mouse is a graphical input device which facilitates speedy and interactive working with the PC.

Mouse cursor

You can move the mouse cursor on your screen by moving the mouse on your desk. The mouse cursor is generally shown as an arrow. The mouse cursor is shown as an insertion point in entry fields; the mouse cursor will be shown as an hour-glass if the PC is busy.

Clicking

Move the mouse cursor to a screen element and press the left-hand mouse button. This is usually called “clicking” or “clicking on” an object.

Clicking opens menus, selects menu entries, options or elements, etc.

Double clicking

Click twice rapidly in succession on an element without moving the mouse cursor. This is called a double-click.

For example, you can start an application by double-clicking on the associated program icon.

Dragging

Move the mouse cursor onto an element. Then press the left-hand mouse button and keep it pressed down whilst moving the mouse cursor to another position. This is called “dragging”.

You can move icons, for example, or determine a zoom section by dragging.

Moving the insertion point

The insertion point is a flashing, vertical line which is displayed in text between two characters. Characters can be inserted at the insertion point position either using the keyboard or by pasting from the clipboard.

To move the insertion point using the mouse:

1. If necessary, move the text displayed using the scroll bars within the window or the list box until the desired section is displayed. To do this, click above or below the scroll button on the scroll bar, depending on the direction of movement required.
2. Click on the position where the insertion point is to be placed.

Marking the text

You can mark parts of the text to edit a certain area of a program or an input field. Further edits can be carried out on the selected area such as deleting, cutting, copying and pasting.

To mark the text by dragging with the mouse:

1. Move the mouse cursor to the start of the text.
2. Drag the mouse over the text which you wish to mark.
3. Release the left-hand mouse button.

Clicking with the right-hand mouse button

If an action is to be carried out using the right-hand mouse button, then this will be specifically mentioned. Otherwise any clicking is to be carried out using the left-hand button. In many applications, clicking on an element with the right-hand button opens a context menu for that element.

Context menus

In many newer Windows programs, commands can also be called up using so-called “Context menus”. A context menu appears when an element or window is clicked on using the right-hand button.

Context menus differ according to the window content or the element selected, i.e. they contain a sensible subset of the main menu entries.

You can use context menus in many areas of WinPISA, although this function will not always explicitly be described. Simply try out the function. Using the context menu for icons in the project window is particularly effective.

General editing functions

The following editing functions are available in most Windows programs for text and often for other elements:

Cut

In cutting, the selected area is removed and transferred to the clipboard. The content which has been cut can then be inserted in another position.

To cut an area:

1. Mark the desired area.
2. Select the [Cut] command from the [Edit] menu.

Copying

When copying, you transfer the selected area to a clipboard without removing it. The content of the selected area can then be inserted in another position.

To copy an area:

1. Mark the desired area.
2. Select the [Copy] command from the [Edit] menu.

Paste

You can paste text from the clipboard.

1. Move the insertion point to the position where the text is to be pasted. Or select the area which you wish to replace.
2. Select the [Paste] command from the [Edit] menu.

Delete

You can delete and remove characters or areas from the program text.

To delete a character or area:

1. Mark the area or the character which you wish to delete.
2. Select the [Delete] command from the [Edit] menu.

The commands “Cut”, “Copy”, “Insert” and “Delete” are also available for programs, axes and I/O modules in the project window. When inserting these commands, you must select the appropriate icon in the project window, as when inserting a new element.

Search/Replace

In order to find certain positions in a text, you can use this command to search for them. You can also replace specified texts by other texts.

You search for a text as follows:

1. Select the command [Search] from the menu [Edit] and enter the text.

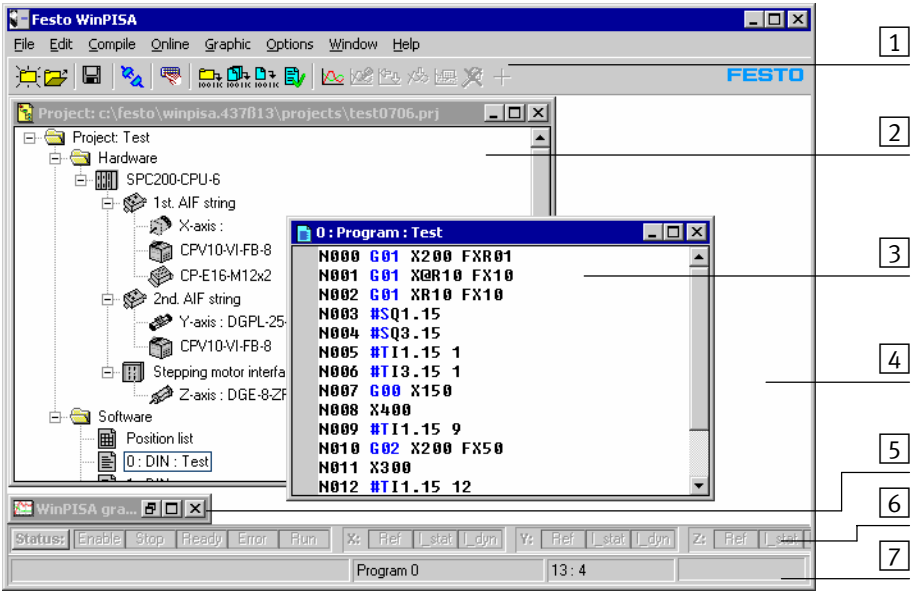
2. Search for the text with “OK”.
   Then search for the next text position with F3 (in the [Edit] menu, command [Search again]).
   With the command [Replace] you can also replace the text specified by a different text. With “Replace” the first text position will be replaced; with “Replace all” all the text positions will be replaced.

1.5.2 Working with WinPISA

The following is a short overview of the areas of the WinPISA window and how to work with windows.

WinPISA elements

In WinPISA windows you will find the following elements:



1 Toolbar

2 Project window

3 Program window

4 Working area

5 Minimized window (icon)

6 Online status display

7 Status line

Fig. 1/12: The WinPISA desktop user interface

Toolbar	Frequently used commands are often available as buttons on the toolbar to make access to them quicker. The command required can be executed directly by clicking on the button with the mouse. The function of a button is shown in the status line when the mouse cursor is moved over it.
Working area	In this area you can work with the various windows of WinPISA.
Project window	Use the project window to manage and configure all elements of your positioning system.
Program window	You will need to open a program window to edit a program.
Window icons	To give a better overview, you can reduce individual windows in the working area to a symbol, as the ex-ample of a graphic (graphic icon) shown here.
Online Status Display	The Online Status Display shows all important system and axis statuses when online mode is active; see section 6.1. The ”Status:” button: opens the ”Status Display” window directly.
Status line	The status line shows the following information:

1 Function/meaning of the menu command or button under the mouse cursor

2 Name of the active window

3 Displays the position of the cursor in the active program window (line:column) or editor mode in the position list

4 Displays “Test mode active” or print progress display

Fig. 1/13: Status line

Working with windows

Different windows are displayed in the working area of the WinPISA program window. You can move these, change their size, reduce them to symbols, etc.

Commands in menu [Window]

The menu [Window] contains commands which affect the windows in the working area.

Command	Function
[Cascade]	Arranges all open windows in the WinPISA working area in a cascade.
[Tile horizontally]	Arranges all open windows in the WinPISA working area next to each other.
[Tile vertically]	Arranges all open windows in the WinPISA working area one below the other.
[Arrange Icons]	Arranges the minimized windows (icons) in the WinPISA working area.
[Close all]	Closes all windows of the type selected in the overlapping menu.
[All to icons]	Minimizes all windows of the type selected in the overlapping menu.
[Restore all]	Restores all windows of the type selected in the overlapping menu to their original size.
[Editor] [Graphic] [Debug] [Message] [Observe]	Applies the [Close all], [All to icons] or [Restore all] command to the appropriate windows.
[1 ...] [2 ...] etc.	All windows in WinPISA will be listed here and can be activated.

1.6 Help system

Operation of the WinPISA software package is described in the online Help. Here you can use the advantages and functions of Windows Help systems, such as context-sensitive help, key word searches, links, etc.
The content of the manual is a large component of the help system.

Help system layout

The components of the help system can be seen in an overview by using the [Contents] command in the [Help] menu.

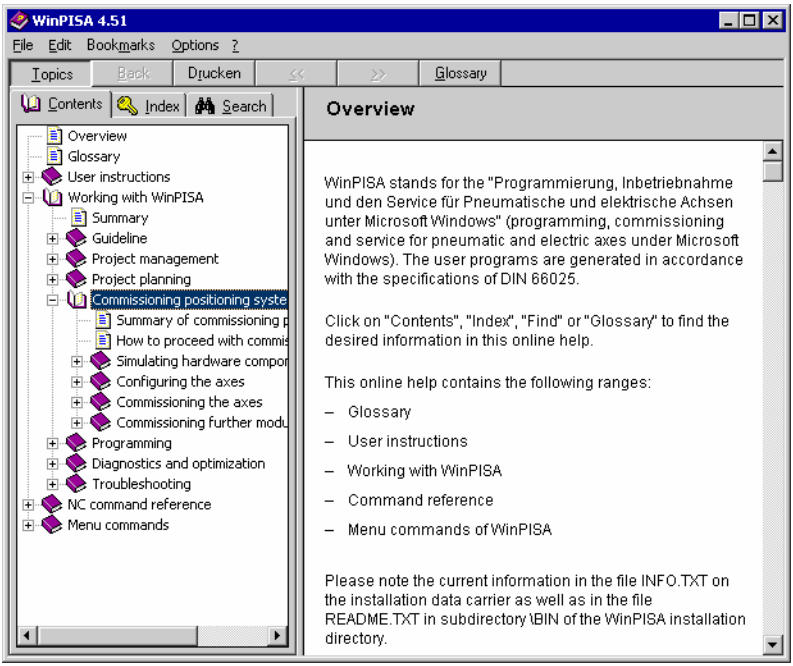

WinPISA 4.51
File Edit Bookmarks Options ?
Topics Back Drucken << >> Glossary
Contents Index Search
Overview
Overview
Glossary
User instructions
Working with WinPISA
Summary
Guideline
Project management
Project planning
Commissioning positioning syste
Summary of commissioning p
How to proceed with commis
Simulating hardware compor
Configuring the axes
Commissioning the axes
Commissioning further modu
Programming
Diagnostics and optimization
Troubleshooting
NC command reference
Menu commands
WinPISA stands for the "Programmierung, Inbetriebnahme und den Service für Pneumatische und elektrische Achsen unter Microsoft Windows" (programming, commissioning and service for pneumatic and electric axes under Microsoft Windows). The user programs are generated in accordance with the specifications of DIN 66025.
Click on "Contents", "Index", "Find" or "Glossary" to find the desired information in this online help.
This online help contains the following ranges:
– Glossary
– User instructions
– Working with WinPISA
– Command reference
– Menu commands of WinPISA
Please note the current information in the file INFO.TXT on the installation data carrier as well as in the file README.TXT in subdirectory \BIN of the WinPISA installation directory.

Fig. 1/14: WinPISA help system

[Help] menu

Use the following commands in the [Help] menu to find relevant information:

- In the left-hand part of the help window (can be masked in or out as required with [Topics]) you will find the following tab cards:
  - The tab card [Contents] contains the index of the help.
  - The tab card [Index] contains selected words.
  - The tab card [Search] enables the search for any number of terms.
- The command [Work with WinPISA] provides an introduction to the functions and methods of working with WinPISA.
- The command [Command reference] provides an overview of the available programming commands and their syntax.

You can call online help at any time in WinPISA with function key F1. With the key combination CTRL+F1 you can directly access a context-related help page, providing this is available. You will also find a “Help” button in many dialogue windows.

Using the help system

The WinPISA help system is compatible with the usual operation of Windows help files. Additional information can therefore be found in your Windows Manual.

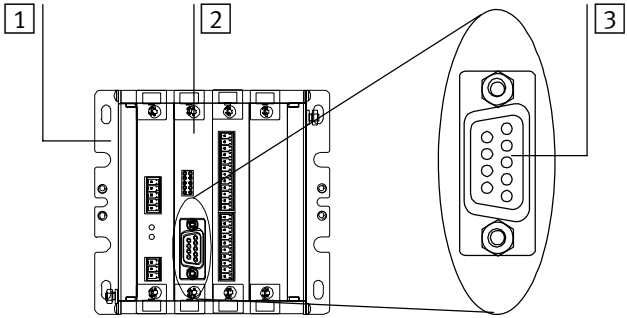
1.7 Online mode

You will need to activate the Online mode to communicate between WinPISA and the SPC200. This opens a connection between the PC and the SPC200 over the RS232 serial interface.

PC – SPC200 connection

Connect your SPC200 to a free serial port on your PC.

Use the diagnostic cable KDI-PPA-3-BU9 intended for this purpose.



1 SPC200

2 Diagnostic module SPC200-MMI-DIAG

3 Diagnostics interface RS232 (X4) – 9-pin port

Fig. 1/15: Diagnostic interface

Configuring data transmission

Once you have connected the PC and the SPC200 you will have to configure communications through the serial interface.

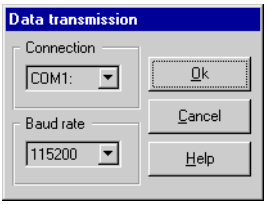


Fig. 1/16: Configure data transmission

1. Select the command [Data transmission] from the [Online] menu.
2. Specify the interface used (COM1 to COM4) and the data transmission rate (baud rate) for the connection.
3. Confirm the settings with “OK”.

Please note
After power-on the baud rate of the SPC200 is preset to 9600 Baud. When online mode is concluded, WinPISA restores this baud rate.

Activating or deactivating the Online mode

- Activate or deactivate the Online mode with the command [Online mode] in the menu [Online] or by clicking the button “Online mode on” or “Online mode off” in the toolbar.
- If functions requiring the online mode are accessed, the online mode will be activated automatically (e.g. upload, download, commands in the [Online] menu).

You can tell whether Online mode is activated by:

– the tick in the menu [Online] on the command [Online mode]

– the depressed button (“Online mode off”) in the toolbar.

When switching to Online mode:

– the interface is reserved for communications with the SPC200,

– a check is made to see if an SPC200 responds to the data transmission settings.

Modified hardware configuration

In the switch-on phase the SPC200 checks the connected hardware. If there are deviations from the saved nominal status, the following Message will be displayed when the Online mode is activated:

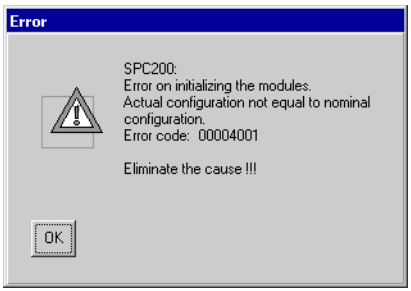
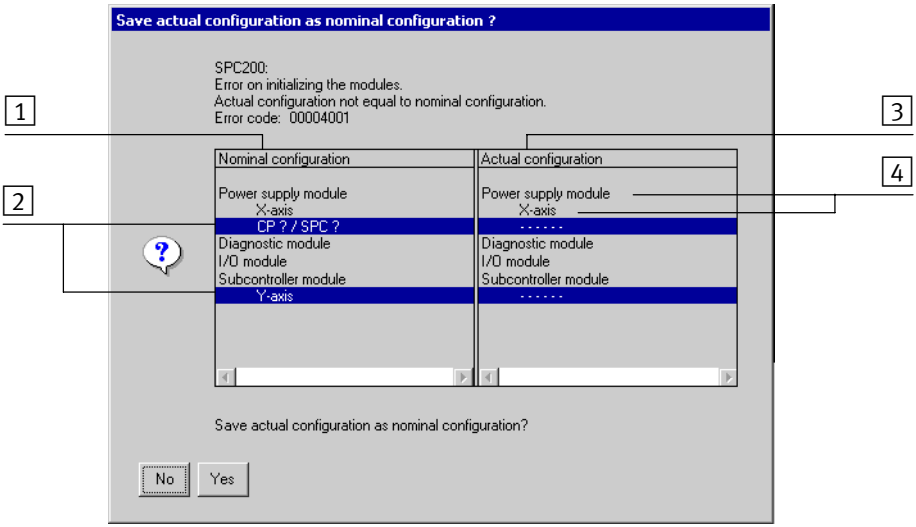


Fig. 1/17: Actual and nominal configurations not the same

Proceed as follows:

1. Confirm the selection with “OK”.
2. The actual and the nominal configurations are displayed in the dialogue window “Save actual as nominal configuration?”.



1 Display of the nominal configuration (hardware configuration saved in the SPC200)

2 Difference between nominal and actual configurations (shown marked)

3 Display of the actual configuration (hardware configuration recognized by the SPC200 when it is switched on)

4 Module in the SPC200 and the axes assigned to the module (or axis interfaces) or I/O modules

Fig. 1/18: Save actual as nominal configuration?

3. Check the actual and nominal configurations now displayed.

   The columns each contain the modules of the SPC200. The axes assigned to the relevant module (or axis interfaces) and I/O modules are shown inset below the module.

   Whether an I/O module exists on the axis interface string, but not the exact type of I/O module, is saved in the nominal configuration. The I/O modules are therefore marked with “CP ? / SPC ?” in the nominal configuration.

Proceed as follows:

If you wish to back-up the data saved in the SPC200 at first with a Project Upload, or if the nominal configuration displayed is correct (e.g. during operation):

- Select “No” in order to retain the nominal configuration displayed in the SPC200 and, if necessary, back-up the data saved in the SPC200 in a WinPISA project (Projekt Upload).
- Check the installation of the modules and components. Check to make sure that the status LEDs of all connected modules light up and that the modules are therefore recognized.

If it is not necessary to back-up the data saved in the SPC200 and if the actual configuration displayed is correct (e.g. during the first commissioning):

- Select “Yes” in order to accept the actual configuration as the nominal configuration.
  If the axis assignment is modified when the actual configuration is saved as the nominal configuration, a data reset will be necessary (see also section “Diagnosis and optimization”).

Caution
During a data reset all data entered will be reset to the status as at delivery or deleted.

Make sure that you have saved the desired data in a WinPISA project (upload), in order to load the data into the SPC200.

4. If a data reset is necessary, the dialogue window “Accept actual as nominal configuration” will be displayed.
   With “Continue” you can carry out the data reset and accept the actual configuration as the nominal configuration.
   With “Cancel” the existing nominal configuration is retained.

Data transmission errors

The following error message will appear if there are problems with data transmission:

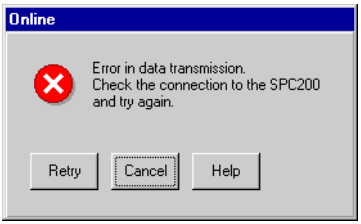


Fig. 1/19: Data transmission errors

First check the cable connection (plug, damage to cable). If no fault can be seen here, then it is possible that data transmission cannot take place at the baud rate specified. This may be because of the PC interface card or unfavourable environmental conditions.

In this case, you should reduce the baud rate until Online mode can be activated.

Project management

Chapter 2

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Contents of this chapter

This chapter gives a summary of the management of your positioning applications in projects. You can edit applications independently of location and keep your data safely.

A project consists of programs and data for setting up and diagnosing positioning systems. These programs and data belong to a certain application, i.e. to a certain task which is solved with the aid of the project.

The WinPISA term “Project” therefore differs in certain aspects from the usual definitions of “Technical Planning” and “Project planning”.

Further information

How to simulate the hardware configuration of an SPC200 in order to commission it is explained in chapter 4.

Instructions on creating programs can be found in chapter 5.

2.1 Managing projects

WinPISA has a number of functions for the management of your project; these are described in the following sections:

- Creating or opening projects
- Saving projects and transferring them to other computers
- Deleting projects
- Print complete projects or parts thereof (programs, position list, hardware, etc.)
- Loading or reading out projects or project components

Project files

WinPISA manages your project in a project file with the file extension "*.PRJ" and in a directory of the same name, the project sub-directory. The project file contains information on the composition of the project. The project sub-directory contains all of the files belonging to the project.

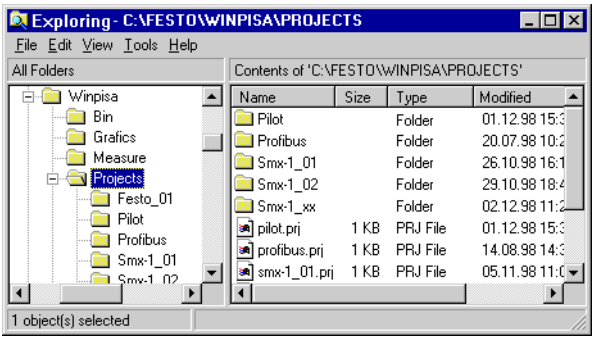

Fig. 2/1: Example of a project directory (Windows Explorer)

The free choice of directory makes it possible to guarantee clarity in managing a number of projects. If necessary, you can create further sub-directories in your project directory to store individual projects.

Projects always consist of the project file and the directory of the same name. Access to a project file in project management always accesses the associated directory as well.

Project window

An open project and the software and hardware defined in it are displayed in the project window.

Individual project components such as the position list, programs and hardware configurations are displayed graphically in a tree structure in the project window (comparable to the representation of directories in the Explorer). A double-click on the icon for a project component is sufficient to check or change settings.

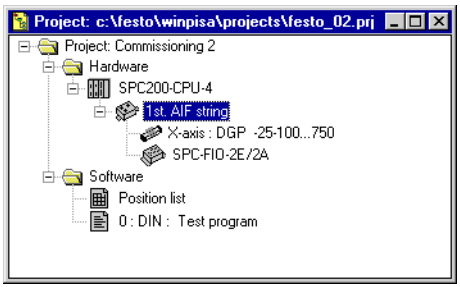

Fig. 2/2: Project window

2.1.1 Creating projects

You must create a new project if you want to program and operate a new positioning system.

To create a new project:

1. Select the [New project] item from the [File] menu, or click on the “Create new project” button in the toolbar.

2. Enter a name for the new project file in the “File name” field of the “Determine project file” dialogue window. The file extension “*.PRJ” will be added automatically.

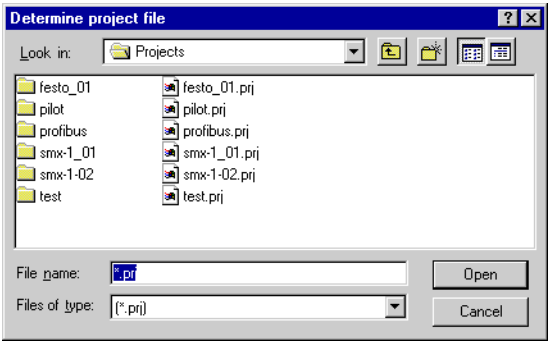

Fig. 2/3: Create project file

The usual filenaming conventions under DOS apply in naming the project file. Project files have the file extension “*.PRJ”.

3. Modify the path under “Look in” if you wish to create the project in another directory or folder.

4. Confirm these entries with “OK”.

5. Enter a project title (max. 20 characters) in the “Title” field and a comment (max. 128 characters) for the new project in the “Description” field of the “Details on project” dialogue window.

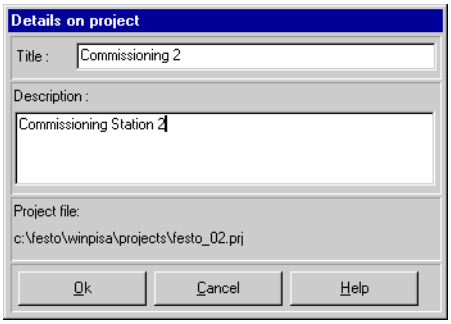

Fig. 2/4: Entering the project title and comment

6. Confirm your input with “OK”.

You can edit the project in the project window which now opens (see Fig. 2/2).

2.1.2 Opening and closing projects

You need to open a project if you wish to do the following in an existing project:

– modify an existing program or position list,

– create a new program,

– modify system data or settings (e.g. after a change of components or to optimize a system).

To open a project:

1. Select the command [Open project] from the [File] menu, or click on the “Open project” button in the toolbar.

2. Select a project file from the “Open project” dialogue window and confirm the selection with “OK”.

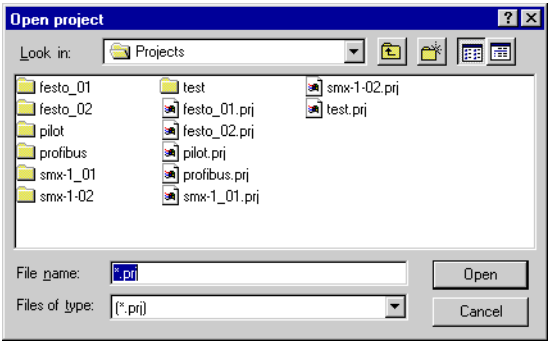

Fig. 2/5: Open project

The last four projects edited will be shown as a list in the [File] menu and can be opened directly.

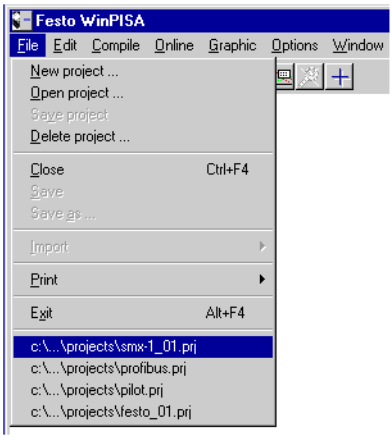

Fig. 2/6: File menu

To close a project:
With a project window active, close projects using the [Close] command from the [File] menu.

If you have modified a project and the modifications have not yet been saved, the modified components will be queried in succession in a dialogue window. “Yes” will save the component displayed, “No” will mean the modifications will be lost.

2.1.3 Saving projects

To save a project:

- Save a project using the [Save project] command from the [File] menu. When you do this, modifications made in the project window and in all editor windows associated with the project will also be saved.

To save only modifications to the project window (such as hardware configurations and newly created programs), activate the project window and select the command [Save] in the menu [File] or click the symbol “Save active window” in the toolbar.

2.1.4 Saving projects under another name

You should save a project under another name when:

– you want to create a backup copy of the project,

– you want to use the project in a modified form for a similar application,

– you want to transfer the project to another computer (e.g. using a network drive or a diskette).

To save a project under a new name:

1. Make the project window active.
2. Select [Save as] from the [File] menu.
3. Enter the name of the new project file and the new project directory in the “Project save as” dialogue window.
4. Confirm your input with “OK”.

The new project will be shown in the project window.

If you have made modifications in open editor windows (program editor, position list), a question will appear, asking if these modifications are to be saved. Answer with “Yes” to save the modifications in the new project; answer with “No” if you do not wish to save them or with “Cancel” if you wish to discontinue saving the project.

2.1.5 Changing the project title and project description

You can allocate titles and comments to your projects. These details are used for clarity, e.g. in project do-cumentation.

– You must enter the project title and description when you:

– create a new project

– upload a project from the SPC200

– save a project under a new name

– wish to modify the name and description of an open project.

In the first three possibilities, you are automatically taken to the “Project details” dialogue window in which you can configure the project. To configure an open project:

1. Select the project icon in the project window.
2. Call up the “Details on project” dialogue window using the [Configure] option from the [Edit] menu or by clicking on the “Configure” button on the toolbar.
3. Enter the program title (max. 20 characters) in the “Title” field and the project description in the “Description” field (max. 128 characters).
4. Confirm your input with “OK”.

You cannot change the name, directory and drive of a project you have already created. Save the project under a different name to do this.

2.1.6 Deleting projects

You may delete a project once it is no longer required.

Please note
Only delete a project if you are sure that you will no longer need it. Create a backup copy beforehand using the [Save as] command if necessary.
A project saved on diskette, a network drive or in a backup directory in this way can be opened again later at any time.

When a project is deleted, the project file and the sub-directory is deleted along with all individual programs and data.

To delete a project:

1. Select [Delete project] from the [File] menu.
2. Select the project file for the project to be deleted from the “Delete project” dialogue window.
3. Confirm your selection with “OK”.
4. Confirm the security question with “Yes” to delete the project. You can stop the delete procedure with “No”.

2.1.7 Uploading projects (Upload)

You upload a project from the SPC200 if:

– you have set up a new positioning system and you want to use the hardware configuration in a new project,

– you want to edit a positioning system for which there is no longer a project.

Please note
If a project contains hardware elements or NC programs with NC commands or NC syntax, which is not supported by the WinPISA version used, an appropriate message will be displayed.

For safety reasons, an NC program cannot be downloaded if non-supported NC commands or NC syntax are used.

This must be observed especially if an older WinPISA version is used together with a new operating system version.

When a project is uploaded, the current hardware configuration as well as existing user programs and the position list will be uploaded from the SPC200.

A project already open in WinPISA will first be closed.

The SPC200 must be connected to the PC (see Online mode) if you wish to upload a project.

To upload a project:

1. Activate the Online mode from the [Online] menu using the [Online mode] item or click on the “Online mode on” button on the toolbar.

2. Select the command [Project] from the [Online] [Upload] menu.

3. Enter the name, directory and drive of the new project file in the “Determine project file” dialogue window just as you do when creating a new project.

4. Confirm your input with “OK”.

5. Enter a project title (20 characters) and enter a comment (128 characters) in the “Description” field of the “Details on project” dialogue window. Confirm your input with “OK”.

While the project is being uploaded from the SPC200, the progress of data transmission is shown in a window. The two bars show the progress of transmission as a percentage. The upper bar represents the whole project and the lower bar the project component currently being transmitted.

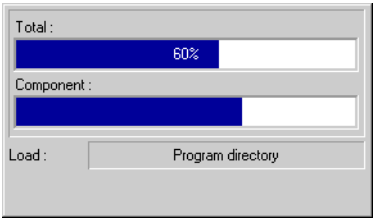

Fig. 2/7: Project Upload

6. Confirm successful transmission with “OK”.

Confirm the prompt and repeat the process should an error occur during transmission.

2.1.8 Loading projects (Download)

You download a project into the SPC200 if:

– you have carried out several modifications to different components of a project being edited and you want to download these to the SPC200,

– you want to download to the SPC200 a complete project you have created offline.

The following conditions must be met for a complete project to be downloaded to the SPC200:

– The project must be compiled free of errors,

– The hardware configuration set in the project must correspond to the actual hardware configuration of the SPC200.

When a project is downloaded, all the data will be restored as in the project in the SPC200. This means that any programs in the SPC200 will be deleted if they do not exist in the project.

Please note
Check the programs in the SPC200 before a project download.

In order to load a project into the SPC200, this must be connected to the PC (see Online mode).

To download a project to the SPC200:

1. Activate the Online mode from the [Online] menu using the [Online mode] item or click on the “Online mode on” button on the toolbar.

2. Select [Project] from the [Online] [Download] menu.

The progress of data transmission is shown in a Window as the project is being downloaded to the SPC200. The two bars show the progress of transmission as a percentage. The upper bar represents the complete project, the lower one shows the project component currently being transmitted. This is shown under “Load”.

3. Confirm successful transmission with “OK”.

Confirm the prompt and repeat the process should an error occur during transmission.

2.2 Editing projects in the project window

Editing a project includes:

- setting hardware configurations
- configuring system components (axis, application and controller data)
- editing the position list
- creating and editing programs.

Projects in WinPISA are shown in the project window. An open project window in the WinPISA window thus shows that the associated project is opened.

Fig. 2/8: Project window

You can clearly display and edit all the components of a project in the project window. These are arranged in a tree structure (similar to the representation of directories in the Explorer) to assist you in this.
The “Hardware” and “Software” areas are located under the project icon. The system components are under “Hardware”. The position list and the positioning programs are in the “Software” area.

Individual objects in the positioning project are represented in the project window by the following icons:

Project
All components in the positioning system are under the Project icon.

Hardware
All hardware elements of the project – SPC200, axes, I/O modules – are managed under “Hardware”.

SPC200-CPU-4 or ...-CPU-6
... stands for an SPC200 with 4 or 6 slots.

1. Axis interface string or 2. Axis interface string
... stands for an axis interface string

Stepping motor interface

X - axis : ... (Y.. , Z.. U..)
... stands for a positioning axis. The axes of a system are identified as X- Y-, Z- and U-axes. This is followed by the axis designation, usually the type.

SPC-FIO-2E/2A or CP...
... stands for an I/O function module, a CP input module or a CP valve terminal. The designation corresponds to the type designation of the relevant module.

Software
The position list and the positioning programs of the project are managed under “Software”.

Position list
... stands for the position list of the project.

1 : DIN “NAME”
... stands for the program with program number 1. Below this is displayed the name you have given the program.

When you create a new project, you will find the hardware icon and the software icon under the project icon in the new project window. The position list is located under the software icon.

These elements are fixed components for each project and cannot be deleted.

The other elements of the positioning system must still be assembled before applications can be commissioned.

Editing objects in the project window

Selecting icons

You can select all the symbols with a mouse click or by shifting the selection with the ARROW KEYS. The menu commands of the menu [Edit] then refer to the icon selected.
You can open the associated dialogue window for configuring or editing components using the ENTER KEY or by double-clicking on the icon.

Revealing and hiding areas

A "(+)" icon before an object name indicates that it has subordinate objects.
Click on the "(+)" icon or press the PLUS KEY when the icon is selected to reveal the subordinate elements. Click on the "(-)" icon which is then displayed or press the MINUS KEY to hide the subordinate elements.

Inserting objects

To insert an object, first select the generic icon under which the new object is to be inserted. Select [Insert object] from the [Edit] menu. A dialogue window will open for you to specify the element to be inserted.

Deleting objects

Select the icon of the component no longer required by clicking on it or by moving the highlight to the icon using the ARROW KEYS. Then select [Delete object] from the [Edit] menu.

Context menu

You can open a context menu for any icon using the right-hand mouse button. The most important commands for the appropriate element will be offered in this menu.

Use the context menus offered when you are editing the project window if you are using a mouse or similar pointing device.

You can carry out many actions more simply and more quickly by selecting the appropriate command.

2.2.1 Editing hardware

You can simulate and configure the components of your positioning system in the hardware area. Do this by inserting the existing components of the positioning system into the project window.

All connected hardware is tested and detected when you switch on the SPC200.
The hardware configuration of an existing system can be uploaded from the SPC200 in Online mode (Project upload, Hardware upload).

Individual components are always inserted in the appropriate point in the tree structure of the project window. The SPC200 is directly under the hardware. Positioning axes and I/O modules should be assigned to an axis interface string or stepping motor interface.

Inserting hardware components

To insert a hardware component in the current project:

1. Select the icon, to which the new hardware component is assigned, in the project window. This is the hardware icon for adding the SPC200 and the icon of an axis interface string or a stepping motor interface for adding an axis or an I/O module.

2. Select the command [Insert object] from the [Edit] menu. The “Insert hardware” dialogue window will open.

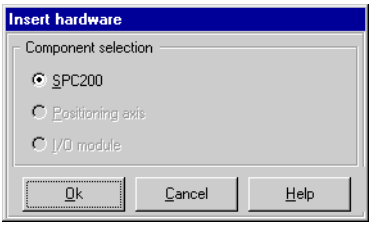

Fig. 2/9: Inserting hardware

3. Select the component to be inserted under the op-tion “Component selection” in the “Insert hardware” dialogue window. Confirm the entry with “OK”.
   Depending on the option selected, a dialogue window will open, in which the component selected is defined in more detail.

Further information on the steps required for inserting hardware components can be found in the section “Commissioning”.

Removing hardware components

To remove a hardware component from the current project:

1. Select the icon of the hardware component in the project window by clicking on it or by moving the selection to the icon using the ARROW KEYS.
2. Select the command [Delete object] from the [Edit] menu.

Please note
When you delete an SPC200, the relevant axes and I/O modules with all the settings will be deleted as well.

3. Confirm the hardware deletion prompt with “Yes” to delete the component. Select “No” to keep the hardware component in the project.

2.2.2 Editing software

You can manage the NC programs and the position list of the positioning system in the software range.

Depending on the requirements and task of the posi-tioning system, you can create up to 100 NC programs (no. 0 to 99). A position list is an integral part of each project and must not therefore be created.

Further information on editing the software can be found in chapter 5.

To insert an NC program (user program) into the current project:

1. Select the Software icon in the project window by clicking on it or moving the selection to the icon using the ARROW KEYS.

2. Select the command [Insert object] from the [Edit] menu. The “New program” dialogue window will open.

3. Enter a program title in the “Title” field and a program number in the “Program no.” field of the “New program” dialogue window. Note that a program number must be unique within a project.

   You can enter a program description or an explanatory text for the program (max. 128 characters) in the “Description” field.

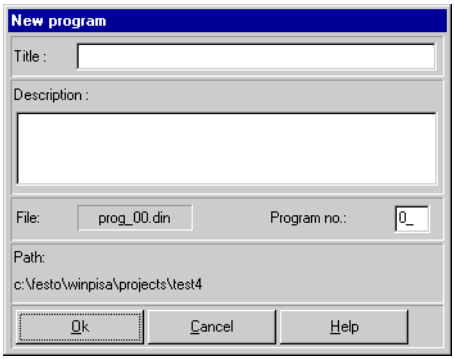

Fig. 2/10: New program

4. Confirm your input with “OK” thereby creating a new program.

To delete an NC program from the current project:

1. Select the program icon by clicking on it or moving the selection to the icon using the ARROW KEYS.
2. Select the command [Delete object] from the [Edit] menu.
3. Confirm deletion of the program in the message window displayed with “Yes” or cancel the deletion process with “No”.

2.3 Printing projects and project components

WinPISA supports documentation and analysis of your positioning applications through easy printing functions.

You can print the following components:

- project information
- hardware information
- programs
- position list
- graphics.

A requirement for printing is that the printer is properly connected to your computer and that the associated printer driver is installed.

Printer set-up

You can install different printers in your system using the Windows Control Panel. In addition, you can modify the set-up of the printer installed.

The Control Panel is located in the Windows Main group. Select the "Printer" icon. You can select the printer to be used from the list of printers installed from the "Printer" dialogue window. With "Options..." you can call up the specific dialogue window for the printer for which you wish to modify the settings.

Detailed information on the installation and set-up of printers can be found in the Windows Manual or in the help texts for the various dialogue windows.

The WinPISA print-outs contain:

Print-out	Contents
Project information	The composition of the current project, basically the content of the project window, in addition to the title and comment entered when the project was created.
Hardware information	The hardware in the project and all parameters set for the hardware in WinPISA.
Programs	Complete print-out of the user programs, as well as the program no., its title and description.
Position list	All positions in the position list, with index, symbol name and comment.
Graphics	The print-out of graphics corresponds to the display in the graphics window but is scaled according to the paper size. It can be worthwhile to set the printer page layout to landscape when printing out graphics.

To print the current project or parts of a current project:

1. Select [Project] from the [File] [Print] menu.
2. Select the components to be printed from “Selection” in the “Print project” dialogue window.

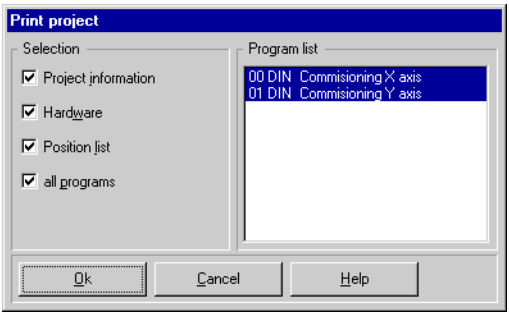

Fig. 2/11: Print project

3. Uncheck the “All programs” check box and select the programs required from “Program list” if you simply wish to print out single programs.
   You can select several entries by pressing down the CTRL key and by simultaneously clicking the individual entries one after the other with the mouse.
   In order to print out all project components, activate all the check boxes under “Selection”.

4. Confirm your selection with “OK”.

5. Check the settings in the “Print” dialogue window and start printing with “OK”.

To print out project information:

1. Select [Project information] from the [File] [Print] menu.

2. Check the settings in the “Print” dialogue window and start printing with “OK”.

To print the contents of open program editor windows, position list windows and graphics windows:

1. Make sure that the window you wish to print is active.
2. Select one of the commands [Program], [Position list] or [Graphic] from the [File] [Print] menu, depending on the active window.
3. Check the settings in the “Print” dialogue window and start printing with “OK”.

To print the hardware overview:

1. Select [Hardware] from the [File] [Print] menu.
2. Check the settings in the “Print” dialogue window and start printing with “OK”.

To print all open graphics:

1. Select [All graphics] from the [File] [Print] menu.
2. Check the settings in the “Print” dialogue window and start printing with “OK”.

2.4 Importing project components

WinPISA allows you to import components from other projects into the current project.

You can import:

– programs

– position list

– hardware

from other projects.

This helps you to save time in building several similar positioning systems.

To import a program into the current project:

1. Make sure that the project window is the active window.
2. Select [Program] from the [File] [Import] menu.
3. Select the program to be imported in the “Import program” dialogue window. The programs in a project are all in the project sub-directory and are named “PROG_xx.DIN”. Confirm your selection with “OK”.
4. Enter a program title in the “Title” field and a program number in the “Program no.” field of the “Import program” dialogue window. Note that a program number must be unique within a project.
5. Confirm your input with “OK” thereby creating a new program.

To insert a position list into the current project:

1. Select [Position list] from the [File] [Import] menu.
2. Select the file “POSLIST.PST” from the project sub-directory of the original project in the “Import position list” dialogue window.
3. Confirm overwriting of the position list in the current project with “Continue”.

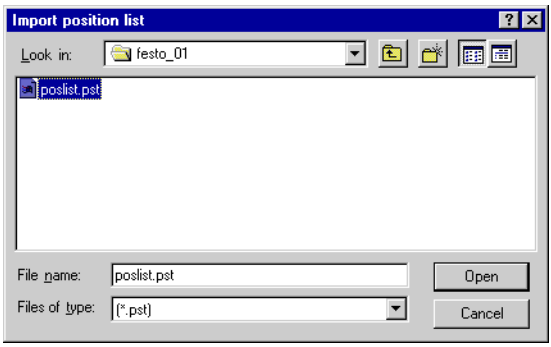

Fig. 2/12: Importing position list

To import hardware in the current project:

1. Select [Hardware] from the [File] [Import] menu.

2. Select the project file for the project from which the hardware is to be imported from the “Import hardware” dialogue window.

3. The hardware of the current project will be overwritten by the selected project if you press “Continue” in the “Hardware” message box; you can keep the existing hardware with “Cancel”.

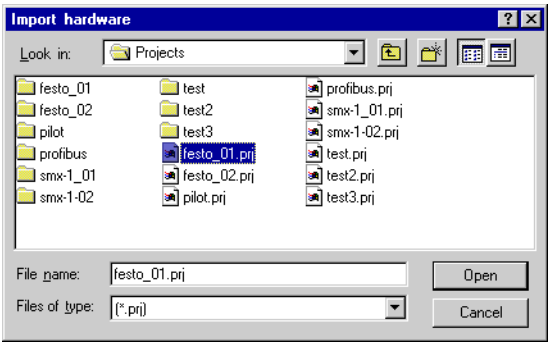

Fig. 2/13: Importing hardware

Project planning

Chapter 3

Contents

3.1 Project planning of axes 3-4
3.2 Selecting planned axes 3-5
3.3 Modifying the axis and application parameters 3-8

Contents of this chapter

This chapter gives a summary of the planned axis systems for the SPC200.

This chapter contains general information on the specifications for permitted axis systems for the SPC200 contained in WinPISA and how you can insert these into a project.

Further information

Further information on permitted axis systems for the SPC200 can be found in the system manual for the SPC200 or in the manual for the stepping motor indexer module.

Further instructions on inserting an axis into a project can be found in chapters 2 and 4.

3.1 Project planning of axes

WinPISA offers support in the selection of suitable cylinder-valve combinations for pneumatic axes or linear axis-motor combinations for electric axes.

For this purpose, WinPISA includes files with the file extension "*.PTA". These files contain planned specifications of the axis parameters and application parameters for the axis systems supported by the SPC200.

Providing you have the project planning tool (PtTool) from Festo, you can save the axis plannings created therein in your own PTA files and use them in WinPISA.
Alternatively you can also transfer the planned axes in the PtTool via the clipboard in WinPISA (see section 4.2).

3.2 Selecting planned axes

In order to load a PTA file, proceed as follows:

1. Open the dialogue window “Parameter set for the ..-axis” for the axis into which you wish to load the specification.

2. Press the button “Select”. The available planned specifications in the directory set for PTA files (see chapter 1) will then be shown in the dialogue window “Axis selection”, depending on the axis type (pneumatic or electric).

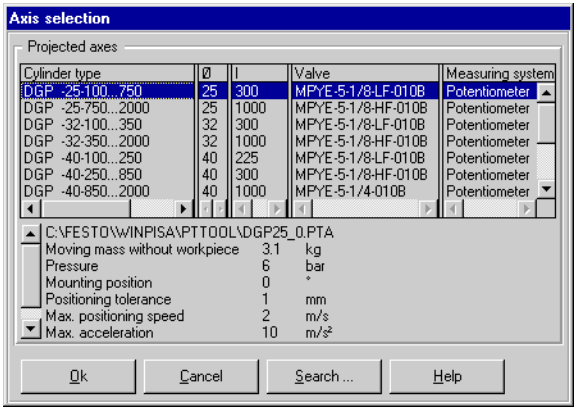

Fig. 3/1: Axis selection (pneumatic axis)

3. Select the appropriate axis from the list under “Projected axes”.
   The name of the PTA file for the relevant axis as well as other information will be displayed.
   Instructions on selecting the correct specification can be found on the following pages.
   You can change the directory with the button “Search”.

4. Confirm the selected specification with “OK”.

Selecting a pneumatic axis

The cylinder type, diameter, length, valve type and measuring system of the specified axes are shown under “Planned axes”. Select the valve-cylinder measuring system combination used.

If the list does not contain an axis with the correct length, select the axis with the next smaller length (see specified length range under “Cylinder type”).

The length entered in the specification corresponds to the minimum length for the valve-cylinder combination.

Example
You have an 40 mm diameter axis which is 600 mm long. In this case select the axis “DGP -40-250...850; ∅40; L250; MPYE-5-1/8HF-010B” under “Projected axes” in the list.

Selecting an electric axis

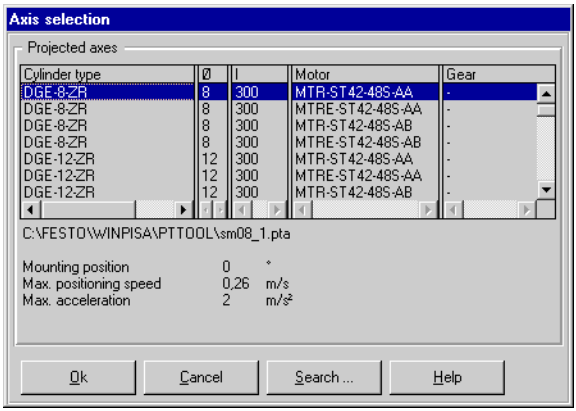

Fig. 3/2: Axis selection (electric axis)

The cylinder type of the linear axis, the diameter, length, motor and, if applicable, the gears of the specified axis are shown under “Projected axes”. Select the linear axis-motor combination used. Then enter the correct length of the axis in the dialogue window “Parameter set for the ..-axis”.

3.3 Modifying the axis and application parameters

The axis and application parameters are accepted in your project when you select the specification.

Check the axis and application parameters transferred before you load them into the SPC200. Correct any values, if necessary, according to your positioning system.

Please note
Danger of collision

If incorrect data is entered in the SPC200, this may cause unexpected movements of the connected actuators.

Information on setting up axis and application par-ameters can be found in chapter 4 or in the manual for the stepping motor indexer module.

Commissioning positioning systems

Chapter 4

Contents

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4.2.1 Uploading the hardware (Online) 4-8
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Contents of this chapter

This chapter describes how to use WinPISA to commission positioning systems with the SPC200.

Commissioning is explained using the example of an axis system with pneumatic axes as well as control via an I/O module.

Further information

In order to carry out commissioning, you should be familiar with the basic operation of WinPISA. Detailed information on this can be found in chapters 1 and 2.

Information on installing and fitting as well as on commissioning with the control panel type SPC200-MMI-1 can be found in the system manual for the SPC200. Information on commissioning on the field bus or of electric axes can be found in the manual for the relevant extension module.

Please note
Positioning axes move with great force and at high speed. Collisions can cause serious injury and/or damage to components.

When commissioning, make sure that:

- the positioning system is correctly installed,
- correct axis and application parameters are entered and downloaded to the SPC200 before the compressed air is switched on,
- nobody can reach into the travel range of the axes when the compressed air is applied.

4.1 How to proceed with commissioning

Mount the components as described in the system manual for the SPC200.

Before you switch on the compressed air or the stepping motor controller for electric axes, you must inform the SPC200 of the conditions of use in your positioning system and the type of components used.

Warning
Faults in parametrizing can cause injury to human beings and damage to property if the controller is enabled with a 1-signal at the ENABLE input.

Enable the controller only if the axis system is correctly installed and parametrized.

Warning
If the tubing of your axis system has been incorrectly connected and you enable the controller, the drive will move at high speed and high acceleration into an end position, depending on the value of the supply pressure (control direction swapped). This can lead to serious injury and damage to components.

Always check the tubing before enabling the controller with a 1-signal at the ENABLE input.

Steps for commissioning

In order to commission the axes, the desired hardware configuration must first be created on the SPC200 and simulated in a WinPISA project. The individual axes can then be commissioned, followed by the complete system.

The following steps are required for commissioning the SPC200 with WinPISA:

1. Create the desired hardware configuration.
2. Simulate the existing hardware configuration in a WinPISA project (see section 4.2).
3. Commission the connected axes.
4. Commission the complete system.

Commissioning pneumatic axes

The following list gives a summary of the activities which are required for commissioning pneumatic axes when the hardware configuration has been simulated in a WinPISA project.

1. Set axis-specific parameters (axis, application and controller parameters) and load the project into the SPC200 (see section 4.3).
2. Check the tubing.
   In order to do this, carry out the movement test (see section 4.4).
3. Only with drives with incremental measuring system: Carry out reference travel (see section 4.5).
4. Carry out the static and dynamic identification travel. During identification travel, characteristic system values, such as friction, hysteresis, acceleration and braking ability are ascertained and saved (see section 4.6).
5. If necessary, calibrate the measuring system. Calibration compensates for tolerances caused by the system between the ascertained position and the actual position (see section 4.7).
6. Move the axis manually (optional). In this way you can check the basic functioning of the controller, as well as the effectiveness of the set software end positions (see section 4.8).

7. Enter a test program (see section 4.9).

8. Set the operating mode and starting programs (see section 4.10).

9. Test the program in Debug mode or in Continuous mode. Observe here the positioning behaviour of the axes (see section 4.11)

Commissioning the system

When all the axes are ready to operate, you can start to commission the complete positioning system. The necessary steps depend on the equipment fitted, e.g.:

- Commission the electric axes
- Commission the field bus module
- Program the user-specific programs, or enter the position register
- Set the operating mode and the starting programs

4.2 Simulating the hardware configuration

You must configure the hardware used when commissioning a positioning system with WinPISA. To do this, you must simulate the hardware in a WinPISA project.

The correct configuration of the hardware in a WinPISA project is necessary:

– for setting the axis, application and controller parameters for the pneumatic axes.

– in order to check the configuration of the hardware. When a project is loaded into the SPC200, the hardware configuration set in the project is compared with the actual configuration. Differences between the ac-tual hardware and that defined in WinPISA are then shown by appropriate messages.

– in order that the available axes as well as input and output addresses can be taken into account during the syntax check of the user programs.

When the SPC200 is switched on, the complete connected hardware (components and connected modules) is checked and ascertained.
You can upload the ascertained hardware from the SPC200 in Online mode (see section “Uploading the hardware”).

Alternatively, set up the hardware components together in the project window according to your planning (see section “Setting the hardware configuration”).

The individual components are always inserted into the tree structure of the project window according to your assignment. The SPC200 is directly under the hardware. Positioning axes and I/O modules should be assigned to the appropriate string.

4.2.1 Uploading the hardware (Online)

You can upload the hardware detected by the SPC200 if you wish to accept the hardware components of a positioning system in WinPISA. The SPC200 automatically carries out a hardware detection test when it is switched on.

To upload the hardware components:

1. Activate the Online mode. Select [Online mode] from the [Online] menu or click on the “Online mode on” button in the toolbar.

If your hardware configuration differs from the saved nominal configuration, you will receive a fault message (00004001). When you have quitted the fault with “OK”, the differences between the actual and the nominal configuration will be displayed (see also section 1.7).
Check whether the actual configuration displayed corresponds to the desired hardware configuration and whether the status LEDs of all connected modules light up (and that the modules are therefore recognized). In this case accept the actual configuration with “Yes” as the nominal configuration.
If the axis assignment has been modified, a further message will be displayed stating that a data reset is necessary for this.

The SPC200 is prepared at the factory to save the current hardware configuration automatically in the first switch-on phase as the nominal configuration (there is no error message).

Data reset

During the switch-on phase, the SPC200 assigns the axis identifiers to the connected axes one after the other. If subsequent modifications are made to the axis configuration, the axis identifiers will be reassigned. In this way, all the user data already entered, such as parameters, programs, the position list as well as the identification and adaption parameters ascertained by the SPC200, are no longer valid.

Caution
During a data reset, all the data entered will be reset to the status as at delivery or deleted.

Always set the correct hardware configuration first and transfer this as the nominal configuration.

If the SPC200 does not contain any data which should previously have been saved in a WinPISA project, you can carry out the data reset with “Continue”.

When the current hardware configuration has been saved as the nominal configuration, you can read out the hardware:

2. Open the project into which you want to load the system configuration.

3. Select [Hardware] from the [Online] [Upload] menu to upload the complete hardware from the SPC200.

Alternatively, you can read out the data completely and save them in a new project (command [Online] [Upload] [Project], see chapter 2).

4. Use [Save project] from the [File] menu to save the project.

Hardware already in the project will be completely overwritten with its settings. In the case of new positioning systems you should first configure the axes.

Check the hardware uploaded to make sure that it is complete. In this way, you can check if all components are in working order and are recognised by the SPC200.

4.2.2 Setting the hardware configuration (Offline)

When you create a new project for a positioning system, modify an existing system or when the SPC200 is not available (no online connection), set the hardware configuration in the project window in accordance with the components available in the positioning system.

The hardware configuration consists at least of:

Fig. 4/1: Minimum hardware configuration

- an SPC200 with
  - a power supply module
  - a diagnostics module
  - a digital I/O module
- a positioning axis.

In addition, a positioning system can contain the following elements:

- in the SPC200:
  - up to 4 digital I/O modules
  - up to 2 analogue input modules
  - a subcontroller module (second axis interface string)
  - up to 3 stepping motor indexer modules
  - a field bus module
- maximum two pneumatic axes per axis interface string,
- one stepping motor axis for each stepping motor interface,
- supported I/O modules with a total of maximum 16 inputs and outputs per axis interface string (see system manual for the SPC200).

Simulating the hardware in the project window

Carry out the following steps to simulate the hardware in your WinPISA project.
The following descriptions refer to the use of the menu commands. You can use the context menus in the project window.

Insert an SPC200

First add an SPC200 to the current project.

1. Select the hardware icon in the project window by clicking it or by shifting the mark onto the icon with the ARROW KEYS.
2. Select the command [Insert object] in the [Edit] menu. The dialogue window “Insert hardware” will then open.

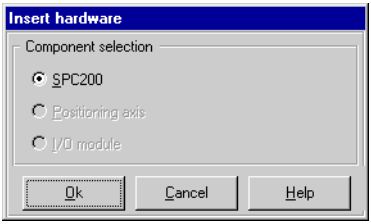


Fig. 4/2: Insert hardware

3. Select the option “SPC200” and confirm this with “OK”. The dialogue window “SPC200 configuration” will be shown.

4. Set the rack for the SPC200 used in the dialogue window “SPC200 configuration”, in the tab “Modules”. Select here under “Base unit” the rack used (4 or 6 locations).

5. Then set the modules used in the SPC200.

The first location on the left in the SPC200 is reserved for the power supply module and cannot therefore be used for other purposes.

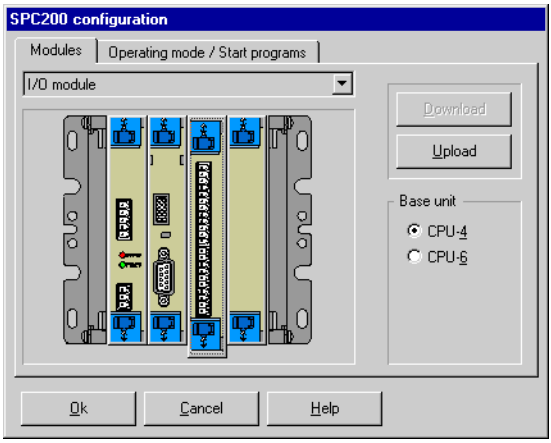


Fig. 4/3: SPC200 configuration

6. Select the locations one after the other in the diagram of the SPC200 by clicking them or by shifting the selection to the relevant location with the ARROW keys. Set the appropriate module for the individual locations in the list box above the diagram.
   Instructions on setting up the modules can be found in the user manual for the SPC200.

   You can later set the operating mode and the active start programs in the tab “Operating mode/Start programs”, see section 4.10.

If a field bus module is used, the tab “Field bus” and “Field bus I/O” will also be displayed.

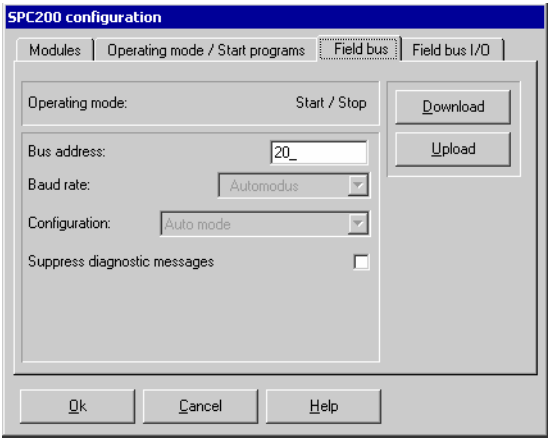


Fig. 4/4: SPC200 configuration – field bus configuration

Carry out the field bus-specific settings (e.g. bus address etc.) in the tab “Field bus”, see manual for the field bus module used.

New feature as from **OS 4.93**

Error messages over the field bus can be suppressed with the check box ”Suppress diagnostic messages” with WinPISA as from version 4.51 in combination with an operating system as from version 4.93. This avoids an undesired stop of the PLC.
A current version of the fieldbus card is also required for this; see description for the field bus card used.

In the tab “Field bus I/O” you can map the local inputs, outputs and flags on field bus I/Os.

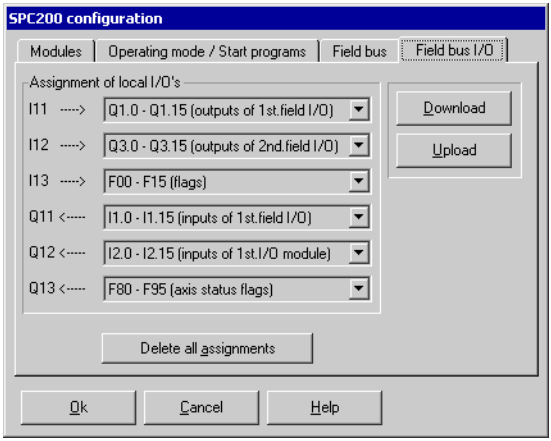

SPC200 configuration
Modules
Operating mode / Start programs
Field bus
Field bus I/O
Assignment of local I/O's
I11 -----> Q1.0 - Q1.15 (outputs of 1st.field I/O)
I12 -----> Q3.0 - Q3.15 (outputs of 2nd.field I/O)
I13 -----> F00 - F15 (flags)
Q11 <----- I1.0 - I1.15 (inputs of 1st.field I/O)
Q12 <----- I2.0 - I2.15 (inputs of 1st.I/O module)
Q13 <----- F80 - F95 (axis status flags)
Download
Upload
Delete all assignments
Ok
Cancel
Help

Fig. 4/5: SPC200 configuration – assign field bus I/O

This means:

I.. -----› : The status of the field bus inputs is copied onto the selected local outputs or flags.

Q.. -----› : The status of the selected local inputs, outputs or flags is copied onto the field bus outputs.

Please note

With older WinPISA versions, the settings undertaken can be reset by means of a Data Reset.

At least WinPISA as from version 4.41 is required for restoring the settings.

Instructions on the operands (I/Os and flags) can be found in section 5.3.

7. When you have assigned all the locations according to the SPC200 used, insert the SPC200 into your project with “OK”.

Insert axis

You can insert a positioning axis into the current project as follows:

1. Select the axis interface string icon in the project window by clicking it or by shifting the selection to the relevant location with the ARROW keys.
2. Select the command [Insert object] in the [Edit] menu.
   - If there are no axes in the clipboard:
     The dialogue window “Insert hardware” will be displayed. Select the option “Positioning axis” under “Component selection”. Confirm this selection with “OK”.
   - If there is an axis in the clipboard, it will be inserted directly (the axis has been copied in or cut out of WinPISA or copied in the project planning tool (PtTool)).

   The new axis will be displayed in the project window under the selected axis interface string. The assignment of the axis identifier takes place automatically. The dialogue window “Parameter set for the .. -axis” will be displayed.

Please note that you must adapt the axis and application parameters of the new axis to the actual axis in your positioning system.

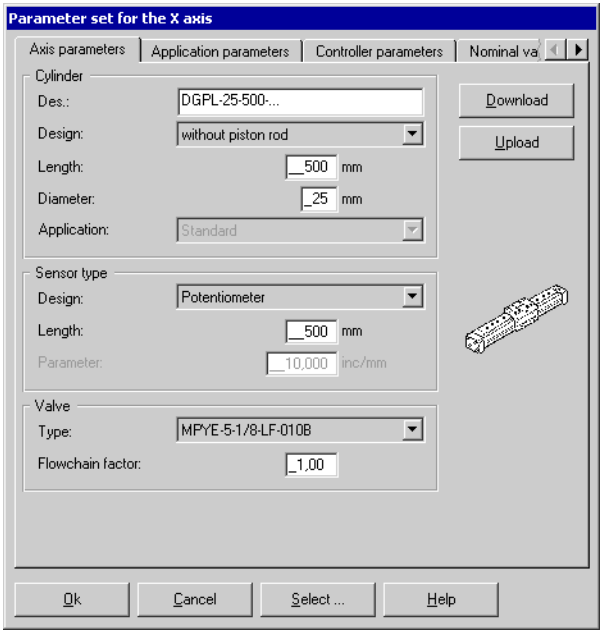


Fig. 4/6: Parameter set for the X axis (example linear drive)

3. A large number of settings and parameters must be defined for a positioning axis.
   Specifications for permitted cylinder-valve combinations can be selected for this purpose. The specifications are saved in planning files (*.pta). A series of typical specifications can be found in the delivery scope of WinPISA. You can create these specifications yourself with the aid of the project planning tool (PtTool).
   Press the button “Select” in the dialogue window “Parameter set for the .. -axis”, in order to select a specification.

   All the axes, which are available in the standard directory for planned axes, are shown under “Projected axes” in the dialogue window “Axis selection”. You can use “Search” to display axes from another directory.

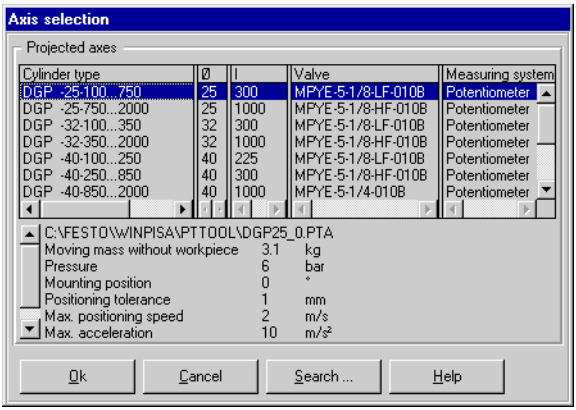


Fig. 4/7: Select axis

Select the axis, which corresponds to the actual axis in your positioning system, from the list “Projected axes”. Instructions on selecting the axes can be found in chapter 3.

Transfer the specification with “OK”.

4. Close the dialogue window “Parameter set for the .. -axis” with “OK” in order to insert further components.

Insert I/O module

You can insert an I/O module into the current project as follows:

1. Select the axis interface string icon in the project window by clicking it or by shifting the selection to the relevant location with the ARROW keys.
2. Select the command [Insert object] in the [Edit] menu.
   - If there are no I/O modules in the clipboard:
     The dialogue window “Insert hardware” will be displayed. Select the option “I/O module” under “Component selection”. Confirm this selection with “OK”.
     Select the used I/O module in the list field “Designation” in the dialogue window “I/O configuration”. As a check the number of inputs and outputs of the selected module are displayed.
     Confirm this selection with “OK”.
   - If there is an I/O module in the clipboard, it will be inserted directly (the I/O module has been copied in or cut out of WinPISA).

   The I/O module is displayed in the project window under the selected axis interface string.

Finally, you should check the complete hardware in the project window.

The hardware configuration set up in the project is com-pared to the actual configuration of the SPC200 as a project is downloaded to the SPC200. Any deviations will be displayed in a message.

4.3 Setting axis-specific parameters

Set the specific parameters for the axes of the positioning system. These include:

Parameter	Description
Axis parameters	Structure, characteristics and components of the axis used
Application parameters	Conditions of use specified by the application
Controller parameters	Settings which affect the control-ling behaviour of the axis
Nominal value input	Settings for the reaction of the nominal value specification

If you select the *.PTA file when inserting the axis, you accept the default values for the valve-cylinder combi-nation of your axis. You then simply have to adapt these values to your par-ticular case.

The specifications of the project-specific parameters for an axis have a direct effect on determining the control-ler para-meters, and thus on the quality of positioning.

If the hardware configuration of the SPC200 corresponds to the project, you can load the configured values of the current tab card into the SPC200 in active Online mode in the dia-logue window “Parameter set for the .. -axis”.

Take note of the warning message displayed when you are downloading the settings and acknowledge with “Continue”.

To configure an axis (example X axis):

1. Open the range of the axis interface string under the SPC200 icon in the range “Hardware” in the project window. Select the icon of the axis to be configured.

2. Select [Configure] from the [Edit] menu or click on the “Configure” button in the toolbar. The “Parameter set for the X axis” dialogue window will be displayed.

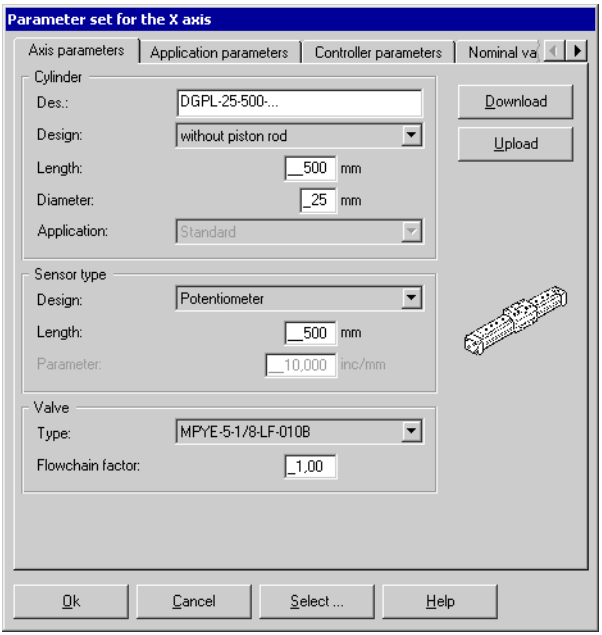


Fig. 4/8: Configuring X axis, axis parameters (example linear drive)

3. Check and correct the entries in the dialogue window “Parameter set for the X axis.” Process one after the other the tab cards “Axis data” and “Application data”. The tab card “Controller data” seres for optimizing systems. You can define settings for the nominal value specification in

the tab card “Nominal value input”. Information on the necessary entries can be found in the following sections.

Warning
Danger of collision!
Entering incorrect parameters will cause unforeseen movements of the connected actuators.

4. If the Online mode is activated, you can load the parameters of the current tab card into the SPC200 with “Download” (with “Upload” you can up-load them from the SPC200).
   Read the warning displayed.

5. Accept the parameters entered with “OK”. The input can be discarded using “Cancel”.

In the case of multi-axis systems, repeat steps 1 to 5 for further axes.

The settings must then be downloaded into the SPC200 to apply the configuration carried out on the individual tabs. “Loading the project into the SPC200” describes how to do this.

4.3.1 Axis parameters

The axis parameters are configuration parameters which describe the installation, characteristics and components of the axis used. The axis parameters form the basis for parameter ranges in application parameters (e.g. possible axis movement speeds).

Set the axis parameters on the “Axis parameters” tab of the “Parameter set for the .. -axis” dialogue window.

Please note
Modified axis data do not become effective until after a program reset. During a download of axis data, WinPISA automatically carries out a program reset (control signal required: 1-signal at ENABLE).

If the axis parameters are modified, the identification data will be reset.

Description of parameters under “Axis parameters” (pneumatic axis)

The parameters for electric axes can be found in the relevant manual (see section “Documentation on positioning”).

Cylinder designation

The designation of the drive used. When axis specifications are inserted, the designation is taken from the *.PTA file. You can overwrite the individual entry.

Cylinder type

The type of the drive. Select here the type of cylinder from the list:

– without piston rod
– with piston rod
– rotary (rotary drive/swivel module).

Cylinder length/ Cylinder swivel angle	The length or swivel range of the drive (see type plate). Permitted: 50 ... 10000 [mm] or [°]
Cylinder diameter	The diameter of the drive used (see type plate).
Measuring system design	Design of the measuring system. Select here the type of measurement system used from the list: – potentiometer – temposonics (digital measuring system) – encoder (the measuring system length is defined fixed with the selection “Encoder”)
Measuring system length/ Measuring system swivel angle	The length or swivel range of the measuring system used (see type plate). Permitted: 50 ... 10000 [mm] or [°]
Measuring system parameter	This parameter is only displayed in the “Encoder” setting of the “Measuring system design” field. The setting is reserved for later developments.
Valve type	Identification of the valve. Here select the type of valve used from the list: – MPYE-5-M5-010B – MPYE-5-1/8-LF-010B – MPYE-5-1/8-HF-010B – MPYE-5-1/4-010B – MPYE-5-3/8-010B

Flow chain factor

The flow chain factor is a measurement of the pneumatic characteristics of the system.

A flow value will be determined by the SPC200 from the axis components specified on the assumption that the connectors provided will be used and hose connections are normal. This will be standardized to a flow chain factor of “1.0”. Deviations can be taken into account by adjusting the flow chain factor.

Permitted: 0.10 ... 1.50

4.3.2 Application parameters

The application parameters are configuration data which describe default conditions of use. The application parameters are the basis for the internal closed loop controller parametrizing.

Set the application parameters on the “Application parameters” tab of the “Parameter set for the .. -axis” dialogue window.

Please note
Modified application data do not become effective until after a program reset. During a download of application data, WinPISA automatically carries out a program reset (control signal required: 1-signal at ENABLE).

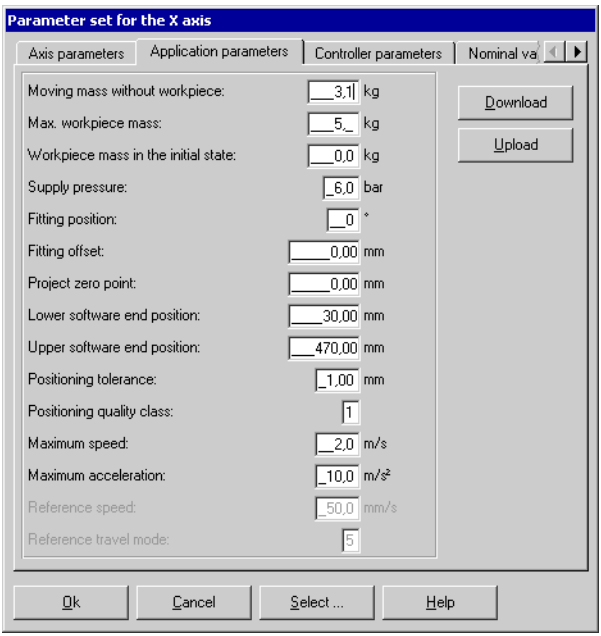


Fig. 4/9: Configuring X axis, application parameters (example linear drive)

Description of parameters under “Application parameters” (pneumatic axis)

The parameters for electric axes can be found in the relevant manual (see section “Documentation on positioning”).

For good positioning behaviour the pneumatic axis must be operated with a permitted mass load. The mass load represents the total mass to be moved. It is composed of:

– the moving mass without workpiece (tool load)

– the workpiece mass (work load).

Recommendation: Use the NC commad M37 if you wish to position with different loads.

Please note
The maximum permitted moveable mass or the maximum permitted mass moment of inertia of the moveable mass depends on the drive type used.

Instructions on determining the permitted total mass (mass load) to be moved can be found in the system manual for the SPC200.

Moving mass without workpiece (tool load)

Mass or mass moment of inertia of all moveable parts of the positioning axis without the mass of the work item. These are e. g.:

– the slide and the piston of the drive

– the fastening elements

– the work item supports such as grippers, in some cases with additional rotary drives or further axes, etc.

Permitted: 0.1 ... 2000.0 [kg] or [$kgm^2 * 10^{-4}$]

Max. workpiece mass (work load)	Maximum mass or mass moment of inertia of the work items to be moved. Example: A machine loads 4 bottles into a crate. The maximum work item mass is the weight of the 4 bottles. Permitted: 0.0 ... 2000.0 [kg] or [$kgm^2 * 10^{-4}$]
Workpiece mass in initial state (minimum work item mass)	Work item mass or mass moment of inertia when the system is switched on. Permitted: 0.0 ... max. work item mass
	The work item mass in basic status is saved in the SPC200 as a percent value of the max. work mass. If the maximum work item mass is modified with the control panel, the work item mass in basic status will therefore also be modified.
Supply pressure	Supply pressure at the valve in bar. For good positioning behaviour: – during movement in front of the proportional directional control valve fluctuations in pressure of max. 1 bar – minimum supply pressure 4 bar.
	Observe the permitted pressure range of the compo-nents used (e.g. DGP...-... max. 8 bar). Permitted: 3.0 ... 10.0 [bar]
Fitting position	Angle of the cylinder and the measuring system to the horizontal (see following diagram). Note the permitted fitting position for the relevant drive (see SPC200 system manual). The fitting position for swivel modules is always 0°. Permitted: -90 ... 0 ... +90 [°]

1 Measuring system connection

2 Fitting position

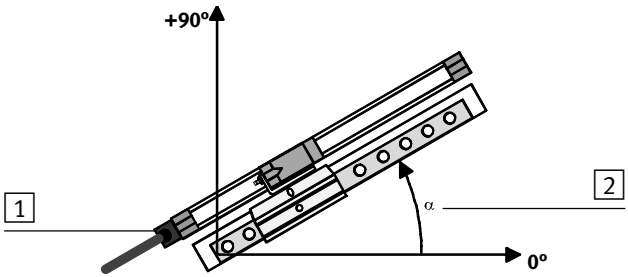


Fig. 4/10: Fitting position of rodless drives (example DNCI-...)

1 Measuring system connection

2 Mounting position

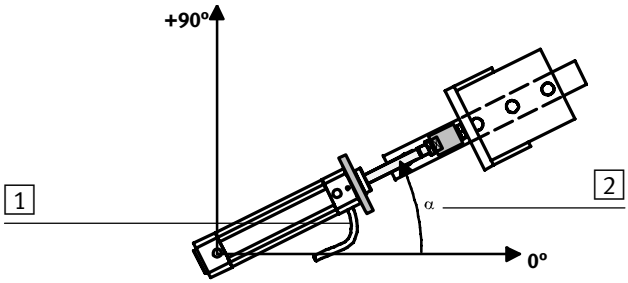


Fig. 4/11: Fitting position of piston-rod drives (example DNCI-...)

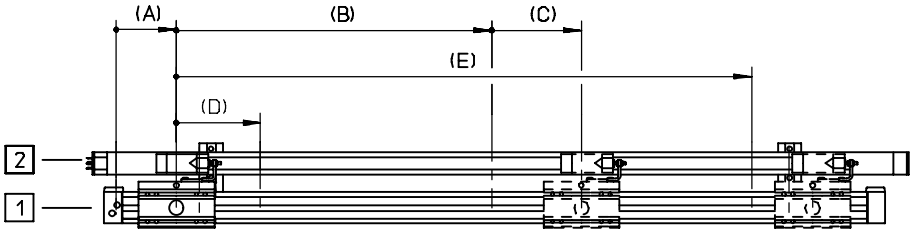
If the supply pressure is modified by more than 1 bar and if the mounting position is modified, the identification data will be reset (see section 4.6).

With the following four parameters you can specify the reference points of your positioning system.

Note that the software end positions and the project zero point refer to the cylinder zero point. If you modify the mounting offset or the reference position, the SPC200 will check to see if the resulting new reference points still lie within the range of the measuring system. If this is not the case, an appropriate fault message will be displayed.

Detailed instructions on the reference points and reference variables for various drives, can be found in the system manual for the SPC200.

Fig. 4/12 shows an example for pneumatic linear drives with absolute measuring system.



1 Linear drive – here DGPL with fitted measuring system

2 Measuring system type TLF

Reference points:
(A) Mounting offset
(B) Project zero point
(C) Actual position
(D) Lower software end position
(E) Upper software end position

Fig. 4/12: Reference points (pneumatic linear drives with absolute measuring system)

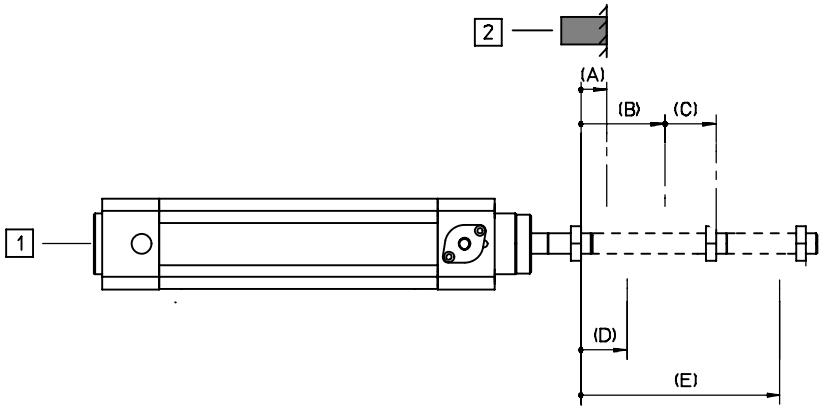
Fitting offset

Only with pneumatic drives with absolute measuring system (e.g. type DGP..., DNCM..., DSMI...):

Offset between measuring system zero point and cylinder zero point (mechanical stop). The fitting offset is positive if the cylinder zero point lies within the measuring system range. The fitting offset is negative if the cylinder zero point lies outside the measuring system range.

Permitted: -10000.00 ... 10000.00 [mm] or [°]

Fig. 4/13 shows an example for piston-rod drives with incremental measuring system.



1 Piston-rod drive – here DNCI with integrated, incremental measuring system

2 Reference stop – either the end stop of the drive itself (reproducibility: ~ 1/10 mm) or fitted externally (reproducibility: ~ 1/100 mm)

Reference points:
(A) Reference position
(B) Project zero point
(C) Actual position
(D) Lower software end position
(E) Upper software end position

Fig. 4/13: Reference points (piston-rod drives with incremental measuring system)

Reference position

Only with pneumatic drives with incremental measuring system (e.g. type DNCI...):

Offset of the reference position, specifies the offset of the axis zero point from the reference point. It is always a positive variable. This offset value also influences the controller optimization of the SPC200, even small values (a few mm) must be specified as accurately as possible.

Permitted: 0.00 ... 9999.99 [mm] or [°]

Project zero point	Point related to the cylinder zero point. All positions occurring in position registers and programs relate to the project zero point. Permitted: 0.00 ... 10000.00 [mm] or [°]
Lower software end position	Defined end position on the side of the measuring system zero point which is monitored by the SPC200 and which must not be overrun. The lower software end position refers to the cylinder zero point and represents the lower limit of the positioning range. Permitted: 0.00 ... 10000.00 [mm] or [°]
Upper software end position	Defined end position on the side of the measuring system zero point which is monitored by the SPC200 and which must not be overrun. The upper software end position refers to the cylinder zero point and represents the upper limit of the positioning range. Permitted: 0.0 ... 10000.00 [mm] or [°]
	If both software end positions are set to “0”, their function will be suppressed.
Positioning tolerance	This parameter states the repetition precision at which a positioning movement is to be carried out. Permitted: 0.10 ... 10.0 [mm] or [°]

Positioning quality class

Describes the conditions under which a motion com-mand is considered complete or when the MC (Motion Complete) signal should be issued.

Quality class	Condition
1	Fast stop without damping period
2	Fast stop with damping period
3	Precision stop without damping period
4	Precision stop with damping period
5	Precision stop with final speed control
6	Precision stop with damping period and final speed control

The quality class entered here is a default setting at the program start. It can be toggled in the program using the G61 and G60 commands.

Permitted: 1 ... 6

Maximum speed

Maximum speed for the process using the G01 and G02 commands. The speed value given in the G01 or G02 commands refers to the maximum speed defined here.

Permitted: 0.1 ... 10.0 [m/s] or [10^3 °/s]

Maximum acceleration

Maximum acceleration for the process using the G01 and G02 commands. You can specify a reduced ac-celeration with reference to the maximum acceleration defined here in the movement program using the com-mands G08 and G09.

Permitted: 0.1 ... 100.0 [m/s^2] or [10^3 °/s^2]

Reference speed

Only with pneumatic drives with incremental measuring system (e.g. type DNCI...):

Speed for the process during reference travel with command G74.

Permitted: 10.0 ... 200.0 [mm/s]

Reference travel mode

Only with pneumatic drives with incremental measuring system (e.g. type DNCI...):

Mode with which reference travel is to be carried out. This presetting applies to reference travel carried out with command G74.

Permitted: 0, 5, 6, 7

Caution
If an incorrect reference travel mode is set, this can lead to collisions, as all positions of the axis refer to the reference point. When carrying out reference travel, make sure that the correct mode is used.

4.3.3 Controller parameters

The SPC200 calculates various controller parameters from the basic parameters. These determine the dynamics (speed) as well as the transfer behaviour of the control. The aim is to guarantee fast no-overswing positioning and with few contour errors (dynamic control error).

The controller parameters calculated by the SPC200 are therefore usually the optimum values. The pneumatic axes used (real axes) do not always correspond to the (ideal) axes used as a basis for regulation. To take into account any possible deviations, the controller parameters can be influenced by factors.

Instructions on optimizing the positioning behaviour can be found in chapter 6.

The factors are standarized to 1.0 by the SPC200. By increasing the factors (> 1), you can correspondingly increase the parameters; by decreasing the factors (< 1), you can correspondingly decrease the parameters.

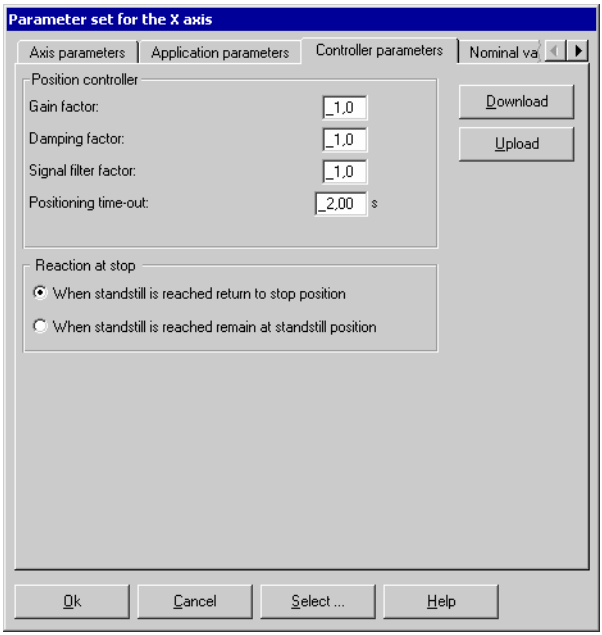


Fig. 4/14: Configuring X axis, controller parameters (example linear drive)

Set the controller parameters on the “Controller parameters” tab of the “Parameter set for the .. -axis” dialogue window.

Description of parameters under “Controller parameters” (pneumatic axis)

Gain factor	With the gain factor, you can influence the sensitivity with which the closed loop positioning reacts to modifications to the measuring variables (position, speed, acceleration). Permitted: 0.1 ... 10.0
Damping factor	Damping is a measure of the transition behaviour of the system from the current to the reference status, especially with fast modifications to the reference value. The system should guarantee low oscillation behaviour with the reference value specification and no-overswing movement into the end position. By modifying the factor for damping, you can influence the transition behaviour of the system. Permitted: 0.1 ... 10.0
Signal filter factor	Speed and acceleration are derived from the path signal and are filtered to improve the signal quality. If a worse signal quality now exists in practice because of, e.g. electrical interference, the filtering of the signal can be influenced by the signal filter factor. If the filtering is too strong, it can destabilize control. Permitted: 0.1 ... 10.0
Positioning timeout	The Positioning timeout monitors whether the positioning procedures are completed quickly enough. The SPC200 will register a fault (MC error) if: – the drive does not start moving within the specified positioning timeout after it has received the positioning command. – the drive exceeds the maximum permitted positioning time (sum of the internally calculated positioning time and the positioning timeout).

If there is an MC error, the drive will be stopped. The current position then becomes the reference position. You can acknowledge the error with a new positioning command.

Select the positioning timeout so that the positioning movements can be completed within the time selected (e.g. 0.5 to 1.0 seconds). The positioning timeout has no effect with the value “0.0”.

Permitted: 0.00 ... 99.99 s

New feature as from **OS 4.93**

Stop behaviour

The stop behaviour can be changed with the options under ”Stop Behaviour” with WinPISA as from version 4.51 in combination with an operating system as from version 4.93.

When standstill is reached, return to stop position	During stopping, the position at the time of the stop signal becomes the setpoint position. After standstill, the axis runs back to this position (default).
When standstill is reached, remain at standstill position	During stopping, the current position at standstill becomes the setpoint position.

4.3.4 Nominal value input

In the tab card “Nominal value input” of the dialogue window “Parameter set for the .. -axis” you can define the presettings for the nominal value specification.

The tab card “Nominal value input” is only displayed if an analogue input module or a field bus module has been configured.

Further instructions on the nominal value specification can be found in chapter 5 of the manual for the NC commands M10 to M14.

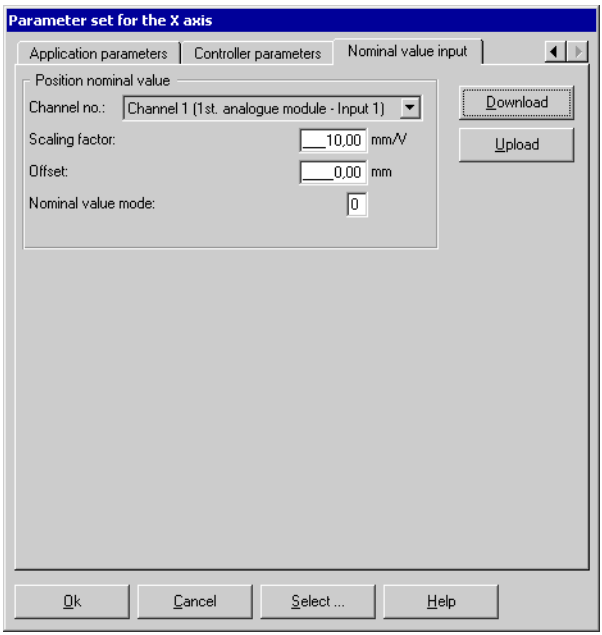


Fig. 4/15: Configure the X axis, nominal value input (example linear drive)

The values set here are valid during a system start or after a program reset until they are modified by one of the NC commands M10 to M14.

Please note
Modified data for the nominal value specification do not become effective until after a program reset. When data are downloaded, WinPISA automatically carries out a program reset (control signal required: 1-signal at ENABLE).

Description of the parameters under “Nominal value input” (pneumatic axis)

Channel number

With the channel number you can assign an analogue channel to the axis (channels nos. 1 ... 4) or the nominal value specification via the field bus (channel 5). Select the desired assignment from the list. See here also NC command M14.

Please note
The digital setpoint value specification via fieldbus always generates an absolute position in mm in the SPC200.

It refers to the project zero point (configured in the application data of the respective axis).

The transferred setpoint value itself corresponds to a position value in units of 0.1 µm for Profibus or in units of µm for DeviceNet.

Scaling factor

With the scaling factor you can specify the positioning path which is to be covered by the analogue nominal value specification (0 ... 10 V) (e.g. factor = 20; possible positioning path = 200 mm). See here also NC command M10.

Permitted: 0.10 ... *9999.90* [mm/V] or [°/V]

With digital setpoint value specification, the scaling factor has no effect.

Offset

By specifying the offset you can shift the reference point for the analogue nominal value specification based on the project zero point. See here also NC command M11.

Permitted: ± *9999.99* [mm] or [°]

With digital setpoint value specification, the offset has no effect.

Nominal value mode

A distinction is made between 5 modes of the nominal value specification. With the mode you define the type of positioning with the analogue nominal value specification. See here also NC command M13.

Permitted: 0 ... 4

4.3.5 Loading the project into the SPC200

Download the whole project to the SPC200 to make all the settings selected in the project effective in the SPC200.

The project must be compiled before it can be downloaded to the SPC200.

To compile the whole project:

1. Save the project using [Save project] in the [File] menu.

2. Select [Project] from the [Compile] menu or click on the "Compile project" button.

3. The progress of compilation is shown in the "Compile" window. Wait until the process is complete.

4. Click "OK" in the "Compile" window to confirm the completed check and compilation.

Check the message window. If errors are displayed, these can be remedied and compilation repeated.
WinPISA will open the associated program and jump to the appropriate program line when you double-click on a message in the message window (see section 4.9).

Please note
A system reset automatically occurs with the following actions:

- Project download with fieldbus module
- Changing the hardware configuration,
- Only for fieldbus:
  Changing the start program, changing fieldbus configuration.

When the system is reset, the axis status flag REF (reference set) is cleared and has to be referenced again; see G74.

To download a project into the SPC200:

1. Select [Online mode] from the [Online] menu or click on the “Online mode on” button in the toolbar to activate Online mode.
2. Click on [Project] in the [Online] [Download] menu.
3. Read the warning displayed. You can load the project into the SPC200 with “Continue”. You can terminate the procedure with “Cancel”.

The progress of data transmission can be seen in a window as the project is downloaded to the SPC200. The two bars show the progress of transmission as a percentage. The upper bar represents the complete project, the lower one shows the project component currently being transmitted.

If an error occurs during transmission, acknowledge the message and repeat the download.

Loading the axis parameters into the SPC200

If the hardware configuration of the SPC200 corresponds to the project, you can load individual data into the SPC200 in active Online mode.

You can load individual data into the SPC200 as follows:

1. Activate the Online mode (command [Online] [Online mode] or click the button “Online mode” in the toolbar.
2. Select the command [Axis parameters] in the menu [Online] from the overlapping menu [Download], in order to load all the configured data for all the axes in the dialogue window “Parameter set for the .. -axis” into the SPC200.
3. Read the warning displayed. You can load the selected data into the SPC200 with “Continue”; you can terminate the transmission with “Cancel”.
   While the data are being loaded into the SPC200, the progress of the data transmission is shown in a window.

If an error occurs during transmission, acknowledge the message and repeat the process.

4.4 Movement test

Always check the tubing of the axes. Besides the visual check of the tubing (see system manual for the SPC200), you can check the functioning of the axis set-up with the aid of the movement test.

During the movement test you can modify the control voltage of the valve. When the supply pressure is switched off, you can observe the reaction of the valve slide in the viewing window of the valve and thereby check the functioning of the valve.

The controller is switched off during the movement test. Therefore the software end positions set with the application data have no effect.

Warning
The controller is switched off during this function. This is to prevent the pneumatic axes from making sudden uncontrolled movements when the supply pressure is switched on. The set software end positions have no effect.

If you wish to carry out the movement test with the supply pressure switched on:

- Make sure that the complete positioning range of the pneumatic axes is free.
- Point out the danger to other people by means of suitable warning signs or protective screens.
- Keep the acceleration forces at a low level. To do this set a low supply pressure of maximum 3 bar and remove the work load and the tool load.

Control signal required for accessing the movement test with the SPC200 with operating system as from V4.6:
0-signal at ENABLE.

Please note
The following control signals are required for carrying out the movement test with the SPC200 with operating system V3.8 (or earlier):
1-signal at ENABLE, STOP and READY.

Carry out the movement test with all operating systems as follows:

1. If necessary remove the work load and the tool load. The mass with which movement is made should be as small as possible in order to minimize acceleration forces.

2. Bring the axis approximately into mid-position. In this way you will create optimum freedom of movement in all directions. Set a pressure of max. 3 bar and switch on the supply pressure.

3. If necessary, activate the online mode (command [Online] [Online mode] or click on the button “Online mode on” in the toolbar.
   If you cannot influence ENABLE manually, activate the test mode (see sections 6.3.1 and 6.3.3).

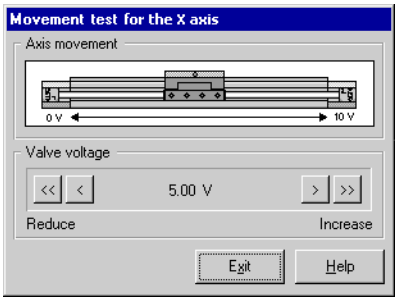
4. Select the command [Movement test .. -axis] for the desired axis in the menu [Online] [Diagnosis].

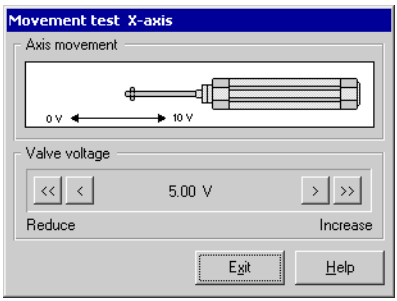
5. Note the warning message displayed. With “Continue” you can continue the movement test, with “Cancel” you can interrupt the function.

6. A message is displayed stating that a 1-signal at ENABLE is now required for the movement test.
   Apply a 1-signal at ENABLE and confirm with “Continue”.
   With “Continue” in active test mode the 1-signal will be set at ENABLE by WinPISA.

The dialogue window “Movement test” will be displayed.

WinPISA sets the control voltage of the valves of the connected axes at first to 5.0 Volt. The control slide of the valve then assumes the mid-position.





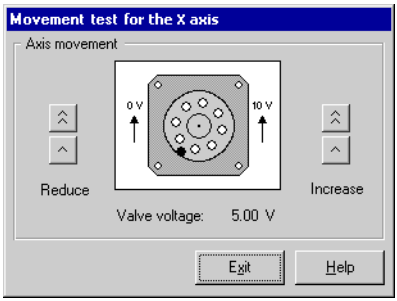


Fig. 4/16: Movement test for rodless linear drives, piston-rod cylinders, swivel modules and standard cylinders with incremental measuring system

7. You can modify the valve voltage with the buttons under “Valve voltage”. If you modify the direction of movement with the buttons, the valve voltage will immediately be set to 5 V.

Button		Function
Reduce	‹‹ or ⌃⌃	Reduces the valve voltage continuously
	‹ or ⌃	Reduces the valve voltage by 0.02 V
Increase	› or ⌃	Increases the valve voltage by 0.02 V
	›› or ⌃⌃	Increases the valve voltage continuously

In order to overcome the static friction, the control voltage must be increased or reduced accordingly.

8. Reduce the valve voltage with the buttons near “Reduce” until the axis starts to move. Check the direction of movement of the axis. To do this you can refer to the display under “Axis movement”. Then set the valve voltage to 5 V with one of the buttons near “Increase” and stop the axis.

9. Increase the valve voltage with the buttons near “Increase” until the axis starts to move. Check the direction of movement of the axis. To do this you can refer to the display under “Axis movement”. Then set the valve voltage to 5 V with one of the buttons near “Reduce” and stop the axis.

Please note
If the axis moves in the wrong direction during the movement test, an appropriate message will be displayed. You must confirm this with “OK”.

Possible reasons for the incorrect direction of movement may be:

– the effect of weight force in vertical mountings
– vibration effects
– incorrectly connected tubing.

Proceed as follows:

- Check the cause.
- If necessary, correct the tubing connections between the valve and the axis.
- Repeat at all costs the movement test.

10. A message is displayed stating that a 0-signal at ENABLE is now required for deactivating the movement test. Apply a 0-signal at ENABLE and confirm with “OK”. With “OK” in active test mode the 0-signal will be set at ENABLE by WinPISA.

Please note
The movement test with the SPC200 with operating system as from V4.6 is deactivated with a 0-signal at ENABLE.

When the movement test is active, no further positioning tasks will be accepted by the SPC200 (fault message).

11. When the movement test has been successfully completed, close the dialogue window “Movement test” with “Exit”.

With multi-axis systems repeat steps 4 to 11 for the other axes.

After the movement test, a rising signal edge is required at the ENABLE input for enabling the controller.

4.5 Reference travel (only with drives with incremental measuring system)

With pneumatic drives with incremental measuring system (e.g. type DNCI...), it is essential that reference travel be carried out before identification travel is undertaken.

During reference travel the reference point of the measuring system is ascertained and saved. Before reference travel can be carried out, the positioning system must be ready for operation.

Please note
Axes with incremental measuring system cannot be positioned without prior reference travel.

In this case fault 00103n04 will be displayed.

Warning
During reference travel one axis of the system will be set in motion.

Pay attention therefore to the possible danger of injury in the range of the positioning system and inform other people of this danger by means of suitable warning signs and/or protective screens.

Necessary control signals:
1-signal at ENABLE, STOP and READY.

Carry out reference travel as follows:

1. Make sure that the tubing of the positioning system is connected correctly (see movement test). Set the compressed air supply to the normal operating pressure. (standard setting = 6 bar).

2. If necessary, activate the online mode (command [Online] [Online mode] or click on the button “Online mode on” in the tool bar).

3. Select the command [Reference travel] in the menu [Online][Commission].

4. Note the warning message displayed. With “Continue” you can continue the function, with “Abort” you can interrupt the function.

5. Select the desired axis in the dialogue window “Reference travel”. Only pneumatic axes with incremental measuring system or stepping motor axes can be selected.
The option “Reference travel” is selected under “Activity”.

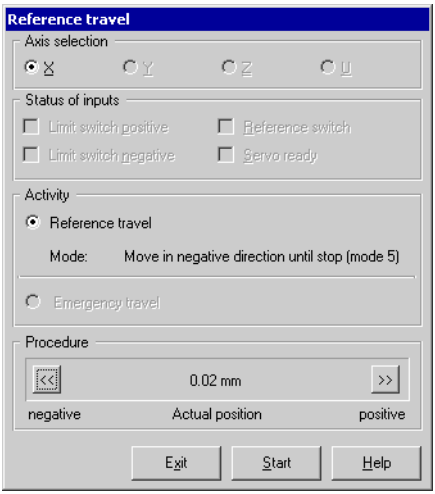


Fig. 4/17: Reference travel

6. Start reference travel with “Start”.

7. During reference travel the “Start” button changes to “Stop”. With “Stop” you can interrupt the current reference travel.

After successful reference travel a message will be displayed. You must confirm this with “OK”. Close the dialogue window “Reference travel” with “Exit” or carry out further reference travel.

4.6 Identification

During the identification travel system characteristic values are ascertained and saved. Before identification travel can be undertaken, the positioning system must be ready for operation.

Before identification travel enter correct values for the axis data and the application data and load these into the SPC200.

Please note
Without identification travel the positioning behaviour will probably be worse.

If modifications are made to the axis data and the mounting position as well as modifications of more than 1 bar to the supply pressure in the application data, the data ascertained during the identification travel will be deleted. New identification travel is therefore required in these cases.

A distinction is made between two different types of system identification:

Types	Description
Static identification	With the static identification, variables are ascertained which have an effect on the behaviour of the system at the beginning and the end of the movement. Static friction of the drive and the valve characteristics in the mid-position range (valve offset and hysteresis) belong here.
Dynamic identification – with the workpiece mass (work load) – without the workpiece mass	With the dynamic identification, the maximum attainable speed as well as the acceleration and delay capacity of the drive system is ascertained. This identification must be carried out with axes which are to move at maximum speed (NC command G00). If considerable modifications to the mass occur during operation, the identification travel must be carried out in each case both with and without the mass of the work item (work load).

In order to guarantee good positioning behaviour, carry out at all costs the static identification and at least one dynamic identification. The NC command “G00” cannot be used without dynamic identification.

If your compressed air supply does not reliably fulfil the required demands (tolerance of ± 1 bar during operation), please refer to the instructions in chapter 6.

Both the static and the dynamic identifications must be carried out during the initial commissioning, when components are replaced, as well as when modifications are made to the drive configuration (mounting position, tubing connections or supply pressure).

Caution
Incorrect axis and application data can lead to collisions during identification travel. This applies especially to the axis length, the mounting offset and the software end positions.

Warning
During identification an axis of the system will be set in motion.

Pay attention therefore to the possible danger of injury in the range of the positioning system and inform other people of this danger by means of suitable warning signs and/or protective screens.

Static identification

Control signals required:
1-signal at ENABLE, STOP and READY.

To carry out an static identification travel:

1. Make sure that the tubing to the positioning system is connected correctly (see movement test). Set the compressed air supply to the normal operating pressure (default setting = 6 bar).

2. Activate the Online mode (command [Online] [Online mode] or click the button “Online mode” in the toolbar.

3. Select [Identification] from the [Online] [Commissioning] menu.

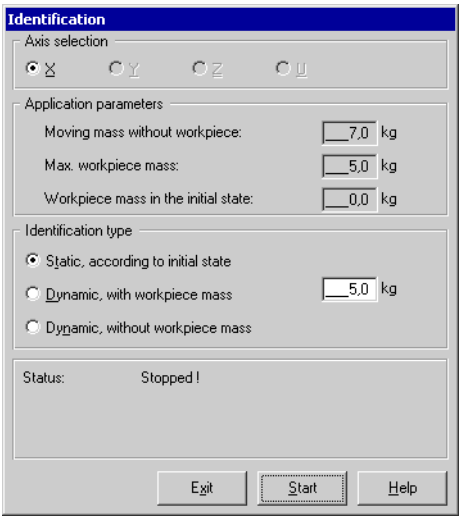


Fig. 4/18: Static system identification (example linear drive)

4. Read the warning message displayed. Click “Continue” to continue with the identification; click “Cancel” to cancel the function.
5. Select the appropriate axis from the “Identification” dialogue window.
6. Select the option “Static, according to initial state” under “Identification type”.
7. Click “Start” to start the identification. The progress of the identification is shown under “Status”.

The identification run takes a certain amount of time.

After a successful identification run, a message will be displayed which you must confirm by clicking “OK”. Click on “Exit” to close the “Identification” dialogue window or carry out another identification run.

In the case of multi-axis systems, repeat the static identification for further axes. Carry out steps 5 to 7 again.

Dynamic identification

Check the settings of the axis and application parameters before dynamic identification.

You MUST carry out a dynamic identification after modifying the axis parameters or after changing a component.

Control signals required:
1-signal at ENABLE, STOP and READY.

To carry out a dynamic identification:

1. Make sure that the tubing of the positioning system is connected correctly (see movement test). Set the compressed air supply to the normal operating pressure (standard setting = 6 bar). Load the axis with the workpiece mass (work load) occurring during operation.

2. Activate the Online mode (command [Online] [Online mode] or click the button “Online mode” in the toolbar.

3. Select [Identification] from the [Online] [Commissioning] menu.

Warning
The axis moves at its greatest acceleration and speed in dynamic identification. Make sure that:
– the full positioning range of the axis is clear,
– the axis configuration has been set correctly and has been downloaded to the SPC200.

4. Read the warning message displayed. Click “Continue” to continue with the identification; click “Cancel” to cancel the function.

5. Select the appropriate axis from the “Identification” dialogue window.

6. Select the option “Dynamic, with workpiece mass” under “Identification type”.

7. Click “Start” to start the identification. The progress of the identification is shown under “Status”.

The identification travel takes a certain amount of time.

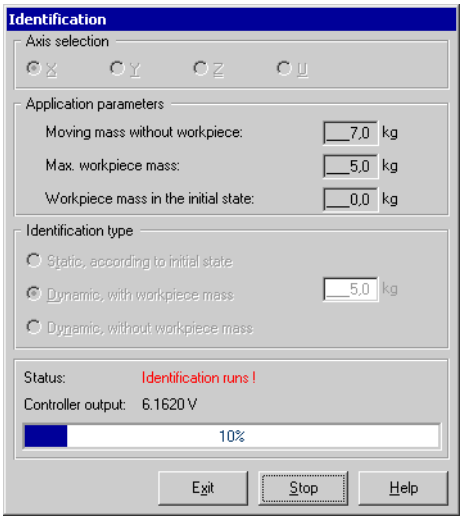


Fig. 4/19: Dynamic system identification (example linear drive)

After a successful identification run, a message will be displayed which you must confirm by clicking “OK”. Click on “Exit” to close the “Identification” dialogue window or carry out another identification run.

If considerable modifications to the mass occur during operation:

- Repeat the dynamic identification without work item (work load) with the selection “Dynamic, without workpiece mass” in step 6.

With multi-axis systems, repeat the dynamic identification for the other axes. Follow here steps 5 to 7.

If identification travel fails:

- Please check the structure, the installation as well as the axis and application parameters of the relevant axis and carry out the identification again.

4.7 Calibrating the measuring system (optional)

With pneumatic drives with analogue measuring system (e.g. types DGP..., DNCM..., DSMI...), calibration equalizes system-relevant tolerances which may occur when the actual position is ascertained.

With pneumatic drives with incremental measuring system (e.g. type DNCI...) or digital measuring system (e.g. type DGPI(L)-... or type DGP(L)-... with measuring system type MME-MTS-...-AIF), calibration has no effect.

The relationship between the positions determined by the measuring system and the actual positions can be displayed as a straight line. Calibration changes the gradient of the line. In this way, the position values determined by the measuring system can be adjusted to the actual measurement.

Carry out a calibration when you want to ensure or im-prove the absolute positioning accuracy.

1 Determined position (measurement system)

2 Before calibration

3 After calibration

4 Current position

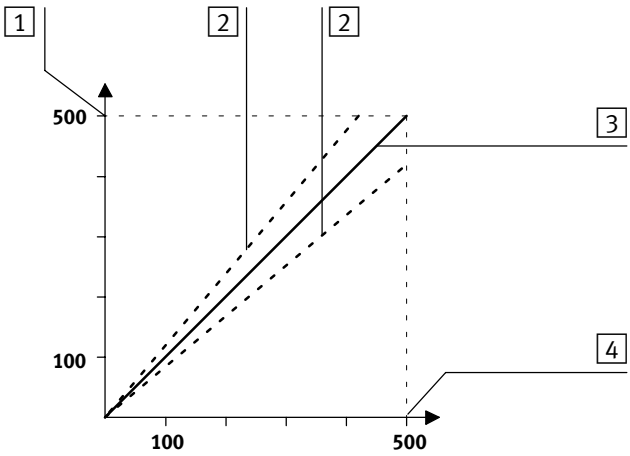


Fig. 4/20: Current and displayed positions (example linear drive)

In calibration, you move to two positions one after the other and measure the actual distance covered.

Use the greatest possible positioning range for the calibration to increase accuracy.

Control signals required:
1-signal at ENABLE, STOP and READY.

You can also carry out the calibration with the system depressurized. Move the axes by hand in this case.

To carry out the calibration:

1. Activate the Online mode (command [Online] [Online mode] or click the button “Online mode” in the toolbar.

2. Select [Calibrate] from the [Online] [Diagnosis] menu.

Warning
One axis of the system will be set in motion in this function. Any running programs will be stopped and reset.

Make sure that it is only possible to reach in to the positioning range of the moving mass when the system is depressurized.

3. Read the warning message displayed. Click “Continue” to continue with calibration, click “Cancel” to cancel the function.

4. Select the appropriate axis from the “Calibrate” dialogue window.

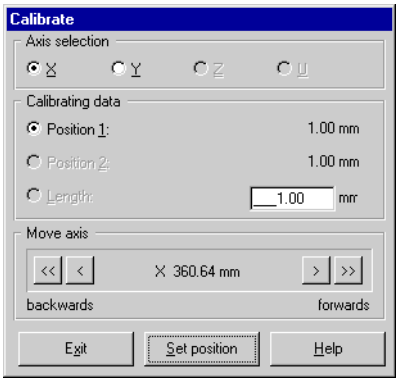


Fig. 4/21: Calibrating (example linear drive)

5. Move the axis to the position which you wish to use as the first calibration position. To do this move the axis with the buttons under “Move axis”. Switch off the supply pressure and move the axis by hand.

Button	Moves the selected axis ...
‹‹	... continuously in a negative direction
‹	... double the set positioning tolerance in a negative direction
›	... double the set positioning tolerance in a positive direction
››	... continuously in a positive direction

6. Mark the position on the axis. Accept the position using “Set position”. The position value will be entered in the “Position 1” field under “Calibrating data”.

7. Move the axis to the position you wish to use as the second calibration position.

8. Mark the position on the axis. Accept the position with “Set position”. The position value is entered in the field “Position 2“ under “Calibrating data”.
   In the field “Length” or “Angle” the length or the angle between the calibration points ascertained by the measuring system are displayed.

9. Measure the distance between or the angle of the two calibration points (e.g. with a tape measure). Enter the value measured in the field “Length” or “Angle”.

The values measured and the values ascertained by the measuring system may deviate max. 10 % from each other.

10. Accept the value entered with “Calibrate”.

In order to calibrate further axes, carry out steps 4 to 10 again.

4.8 Move axis manually (optional)

In order to check the basic functioning of the axis, you can move the axis manually. In this way you can check, e.g.:

– whether the axis is positioned as expected (error elimination see appendix B),

– that the software end positions function correctly.

You can move the axis manually by means of the following functions:

– Calibration (see section 4.7)

– Optimize position (see section 6.4)

– Teach position (see section 5.1.2)

Instructions on moving the axis can be found in the relevant sections.

If you wish to test only the basic movement function of the axis, you can use the movement test for this purpose (see section 4.4).

4.9 Enter a test program

When the positioning system is commissioned, it is often useful to test its functioning using a simple program.
You can do this by pasting a program into your project, then programming a few movements and checking your program for the correct syntax.

In order to avoid unnecessary error messages in the switch-on phase, programs 0 and 1 have already been created in the SPC200 when it is supplied. These programs both contain the NC record N000 with the command M30. Your project will therefore already contain these programs after a project upload. In this case, do not create a new program. Open an existing program instead.

Create and open the program

To insert a test program into the project:

1. Select the software icon in the project window by clicking on it or by moving the highlight to the icon using the ARROW KEYS.
2. Select [Insert object] from the [Edit] menu or press the INSERT key.
3. Enter a program title in the “Title” field, a short description in the “Description” field and the program number required in the “Program no”. field of the “New program” dialogue window.
   Enter “Test” as your title and accept the program number “0” in order to test the positioning system.
4. Click “OK” to confirm your entries. The new program appears in the project window. The program window is opened.

Open the program window later by selecting the associ-ated program icon in the project window and pressing ENTER.

Programming

Now enter a few simple movements, e.g.:

NC record	Description
`N000 G01 X100 FX10`	Move at 10 % of the defined maximum speed to position X = 100 mm
`N001 G01 X200 FX10`	Move at 10 % of the defined maximum speed to position X = 200 mm
`N002 M30`	Program end with repeat

The program window now appears as follows:

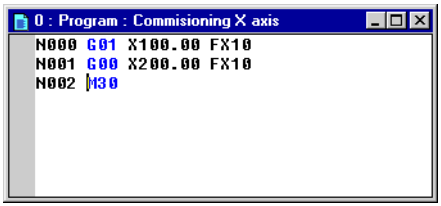


Fig. 4/22: Program window

The records “N000” and “N001” contain the positioning commands for the axis. In the example positions have been chosen for an axis with the length 300 mm. Adapt the positions according to the possible positioning range.

Move at reduced speed in the program example (e.g. “FX50” corresponds to 50 % of the maximum defined speed). If applicable, insert a brief pause after each positioning move (e.g. G04 100) so that you can observe the movement better.

When commissioning multi-axis systems, we recommend that you check all the axes one after the other with your own program.

Further information on programming can be found in chapter 5.

Syntax check

Now check the program entered for correct syntax.

To check the syntax of programs:

1. Make sure that the program window of the program to be checked is active.

2. Select [Syntax check] from the [Compile] menu or click on the “Syntax check” button.
3. The progress of the syntax check will be displayed in the “Compile” window. Wait until the checking procedure is complete.
4. Click “OK” in the “Compile” window to confirm the completed check.
5. Check the message window. Rectify any errors displayed and repeat the syntax check.

Saving the test program

Save the content of the relevant editor window to keep the modifications made.

To save modifications in an editor window:

1. Make sure that the editor window of the program is the active window.

2. Select [Save] from the [File] menu or click on the “Save active window” button in the toolbar.

The contents of the window will then be saved.

Closing the program window

Close the relevant editor window once the test program has been entered and checked for correct syntax.

To close an editor window:

1. Make sure that the editor window of the program is the active window.
2. Select [Close] from the [File] menu.

Loading a program into the SPC200

Close the relevant editor window once the test program has been entered and checked for correct syntax.

You can load a program into the SPC200 as follows:

1. Select [Programs] from the [Online] [Download] menu.
2. Select the desired program(s) in the window “Download programs”. Load these programs into the SPC200 with “Download”. Confirm the messages for saving or translating with “Continue”.

Deleting programs in the SPC200

You can delete programs in the SPC200 which are no longer required, e.g. when you have created several test programs which you no longer require.

You can delete programs in the SPC200 as follows:

1. Select the command [Delete programs] in the menu [Online][Commissioning].
2. Select the desired program(s) in the window “Delete programs”. Delete the selected programs with “Delete”.
3. Close the dialogue window with “Exit”.

When a project is downloaded, the contents of the project and of the SPC200 are synchronized. All data (also programs), which do not exist in the project, will automatically be deleted in the SPC200.

4.10 Set the operating mode and start programs

When you set the operating mode and start programs, you define the behaviour of the SPC200 during the program sequence.

Operating modes

The SPC200 offers the following two operating modes for running stored NC programs:

– Start/Stop mode

– Record select mode

Start/Stop

In the Start/Stop operating mode, the SPC200 is able to control simple positioning tasks on its own. Any synchronisation with externally controlled processes necessary is supported by the “Programmed stop” (command M00).

Record selection

The record selection operating mode supports close coupling of the SPC200 with a controlling PLC. 32 NC records can be retrieved through 5 digital inputs. Positioning commands, positioning conditions and com-mands for setting the positioning quality class are permitted in this operating mode.

Please note
The different operating modes of the SPC200 behave differently during program processing.

Further information on the operating modes can be found in the system manual for the SPC200.

Start programs

The SPC200 allows the specification of start programs.

An SPC200 can control two work stations. It thereby supports both the coordinated and the autonomous modes in both work stations. Parallel program processing capability is not used in co-ordinated mode. Only one start program is defined (one active task). This program controls all the axes. In autonomous mode, two start programs (two active tasks) are defined. Each start program controls a different work station. Further information on coordinated and autonomous operation can be found in chapter 5 or in the system manual for the SPC200.

In order to check the axes during commissioning, define the test program entered as a start program. This setting can be modified later to reflect the design of your positioning system.

Setting the operating mode and the start programs

You can set the operating mode and the start programs as follows:

1. Activate the Online mode by selecting [Online mode] from the [Online] menu or by clicking on the “Online mode on” button in the toolbar.

2. Select the SPC200 icon in the project window and press the ENTER key (alternatively: select the SPC200 icon and the command [Edit] [Configure] or double-click the SPC200 icon).

3. Activate the tab card “Operating mode/Start programs” in the dialogue window “SPC200 configuration”.

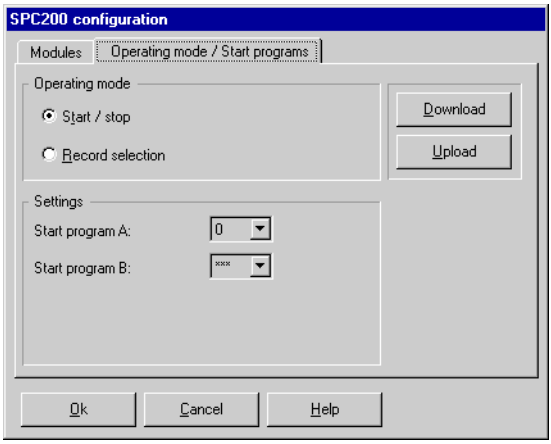


Fig. 4/23: Setting the operating mode and start programs

4. Select the desired operating mode of the SPC200 under “Operating mode”.
   Recommendation: select the option “Start / stop” in order to commission the SPC200.

5. Select the number of the start program for task A under “Start programs” in the list box “Start program A”. In order to commission the SPC200, select here “0” (the number of the test program).

6. Select the program number of the start program for task B in the “Start program B” list box. Select “ *** ” here for commissioning purposes. The entry “ *** ” means “No start program defined”. The SPC200 will work in co-ordinated mode.

In the list boxes “Start program task ..”, all the program numbers from “0” to “99” will be offered. If a program number, which does not exist in the SPC200, is selected, an appropriate error message will be shown when the settings are loaded into the SPC200.
If necessary, check to see which programs exist in the SPC200 (e.g. with [Online] [Upload] [Programs]).

7. With “Download” you can load the settings for the operating mode and the start programs into the SPC200.
   Read the warning message displayed. Select “Continue” in order to load the settings into the SPC200. If the download is successful, the settings for the operating mode and the start programs will become active in the SPC200.

8. Confirm the modifications in the dialogue window “SPC200 configuration” with “OK.” Save the project in order to keep the modifications.

Alternatively, all the settings made in the dialogue window “SPC200 configuration” can be loaded into the SPC200 with the command [Online] [Download] [SPC configuration].

4.11 Testing or starting programs

When you have carried out the steps for commissioning the axes, test the functioning of the system with the test program created.

There are various ways of testing the program. Start the program:

– in Debug mode in WinPISA (see chapter 6),

– via I/O signals (see system manual for the SPC200),

– with the control panel (see system manual for the SPC200).

Recommendation:
Create a test program for commissioning each axis. Check the positioning behaviour of each individual axis first in Debug mode.
Observe the behaviour of the axis while the program is being processed.

In order to monitor registers and flags as well as inputs and outputs, you can use the monitoring functions in the menu [Online][Observe]. You can also influence the operands in the test mode (see section 6.3).

Programming

Chapter 5

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Contents of this chapter

This chapter contains basic information on programming the SPC200 with WinPISA. Both the coordinated and the autonomous modes are explained and all the NC commands are described.

You must determine the positioning and control sequence for the axes of a positioning system in user programs. The procedures for creating user programs comply with DIN 66025.

In this chapter you will learn how to:

- create new user programs
- open programs and edit them
- manage the position list
- check new or amended programs for correct syntax
- compile programs for the SPC200
- load the programs and the position list into the SPC200 or read them out of the SPC200.

WinPISA supports you in creating user programs for the SPC200 by means of logical program management and a user-friendly programming environment.

Further information

Information on programming with the control panel type SPC200-MMI-1 can be found in the system manual for the SPC200.

5.1 Program administration

The project window provides an environment for easy management of user programs.

All programs and the position list are allocated to the “Software” area; you will therefore find these under the software icon of the project window.

You can use up to 100 programs in programming for the SPC200, using program numbers 0 to 99. You can describe the task or function of a program using a name and a comment for easier orientation.

A position list is a fixed component of each project. It cannot therefore be deleted or created.

Creating a new program

You create a new program when you want to specify a new positioning task.

To create a new program:

1. Select the software icon in the project window by clicking on it or moving the highlight to the icon using the ARROW KEYS.
2. Select [Insert object] from the [Edit] menu or press the INSERT key.
3. Enter a program title in the “Title” field, enter a short description in the “Description” field, and enter the program number required in the “Program no.” field in the “New program” dialogue window.
4. Click “OK” to confirm your entry. The new program appears in the project window. The program window is opened.

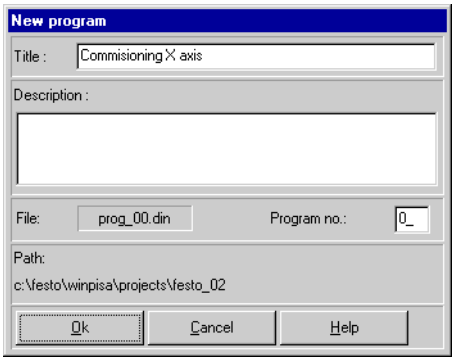


Fig. 5/1: Creating a new program

The meaning of the information is as follows:

Field	Description
Title	The title of the program in maximum 20 characters. A self-explanatory title makes it easier to find programs in the project window.
Description	A short description of the program (maximum 128 characters). Here you can make a note of the task, the mode of operation or particular characteristics of the program.
Program no.	Number of the program. The lowest free program number of the project is selected by default. A program number must be unique within a project.

The name of the new program file will be shown in the “File” field (“PROG_00.DIN”, PROG_01.DIN”, etc.).

Saving a program or a position list

Save the content of the appropriate editor window to save modifications made to a program or a position list.

To save modifications in an editor window:

1. Make sure that the editor window of the program or the position list is the active window.

2. Select [Save] from the [File] menu or click on the “Save active window” button in the toolbar.

Exporting a program

You can save individual user programs in any file using [Save as].

To export a program:

1. Make sure that the editor window of the program is the active window.
2. Select [Save as] from the [File] menu.
3. Enter a file name for the new program file in the “Save program as” dialogue window. Modify the settings unter “Save in” if necessary.
4. Click “OK” to confirm your entry.

You can later merge the exported file back into a project by selecting [Program] from the [File] [Import] menu.

Opening a program or a position list

The appropriate editor window must first be opened before you can make modifications to a program or the position list. Open editor windows are displayed within the WinPISA window.

To open a program or the position list:

1. Select the icon for the program or position list in the project window by clicking on it or by moving the highlight to the icon using the ARROW KEYS.
2. Open the relevant editor window by pressing ENTER or by double-clicking on the icon.

Closing a program or position list

Close the relevant editor window once you have finished editing a program or position list.

To close an editor window:

1. Make sure that the editor window of the program or the position list is the active window.
2. Select the command [Close] in the menu [File].

Alternatively you can close windows by double-clicking on the system menu.

When you close a window in which you have made modifications, a confirmation prompt will appear asking whether the modifications are to be saved.

Deleting a program

A program you no longer require can be deleted from the project.

Please note
A program is removed from the hard disk when you delete it.

Therefore, please make sure that you really no longer require the program. If necessary, create a backup (Save as) before deletion.

To delete a program:

1. Select the program icon in the project window by clicking on it or by moving the highlight to the icon using the ARROW KEYS.
2. Select [Delete object] from the [Edit] menu or press the DELETE key.
3. Confirm deletion of the program by replying with “Yes” to the “Delete” confirmation prompt.

Modifying the program titel, the program description and the program number

You can allocate a different program number to an existing program or modify its program title or program description.

To modify the title, the description or the number of a program:

1. Open the program editor window and make sure that it is the active window.

2. Select [Configure] from the [Edit] menu or click on the “Configure” button in the toolbar.
3. Enter the desired modifications in the “Program” dialogue window.
4. Click “OK” to confirm your entry.

The name of the relevant program file is automatically changed when you modify the program number.

This guarantees that the program filename and program number are compatible (a program with the number “0” has the filename “PROG_00.DIN”, etc.).

5.1.1 The Program editor

The WinPISA program editor is a tool for creating and editing user programs for the SPC200.

When you open a program, its content appears in a program editor window within the WinPISA window. You can open any number of programs and display them simultaneously in the WinPISA window.

To switch between programs, open the [Window] menu. All open windows will be shown as menu items. Select one of the items in order to move to the relevant window.

All modifications made to the program content are known as edits.

1 Record numbers, positions and parameters (black)

2 NC commands (blue)

3 Comment text (green)

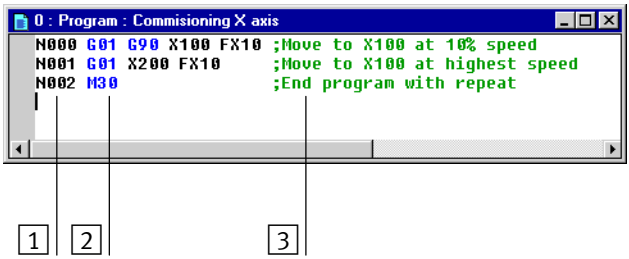

0 : Program : Commisioning X axis
N000 G01 G90 X100 FX10 ;Move to X100 at 10% speed
N001 G01 X200 FX10 ;Move to X100 at highest speed
N002 M30 ;End program with repeat
1
2
3

Fig. 5/2: Program editor

Features of the program editor window

Highlights

In the program editor window, NC commands are marked in blue and comment text in green (syntax highlighting).

Context-sensitive helps

If the cursor is placed in an NC command, the relevant help page can be accessed with the key combination CTRL + F1.

Cursor position

The position of the cursor is shown in the format “Line:column” in the status bar of the WinPISA window.

Edit functions

A program must be open before you can edit it. The user programs for the SPC200 are created in text form. You therefore write your program as a normal text.

Menu commands

The editor has all the usual functions for editing pro-grams, e.g. found in the “Windows Notepad”. The [Cut], [Copy], [Paste], [Search], [Replace] and [Delete] edit commands are found in the [Edit] menu. Information on the function of the commands can be found in chapter 1.

Undo

You can undo certain operations when you are editing programs. The commands are [Cut], [Paste], [Delete], [Replace] and [Number]. Only the last operation can be undone. Additionally, the replacement of selected text by a character sequence can be reversed.

This is how you can reverse an action:

- Select [Undo] from the [Edit] menu.

Keyboard procedure

You can also use the usual Windows keyboard shortcuts to edit the text in addition to the menu commands (see “Working with Windows applications”).

Numbering

Programs can be automatically numbered at any time. This saves the time-consuming job of manual numbering.

Branch destinations are updated automatically thereby.

Please note
Branch destinations, which cannot be assigned clearly, are marked by a question mark and must be checked and corrected if necessary.

To number a program:

1. Select [Number] from the [Edit] menu in the active program window.
2. Enter the numbering settings required under “Settings” in the “Number” dialogue window.
3. Click “OK” to confirm your entry.

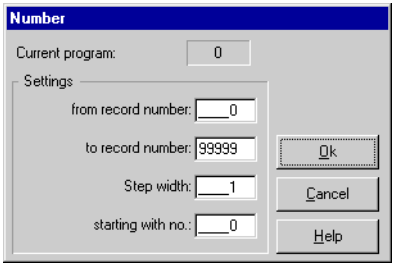


Fig. 5/3: Numbering

The following settings are available for numbering:

Field	Description
from record number	The record number from which numbering is to start. The upper record number is entered as a default, i.e. the program will be numbered from the first record. Transfer the default or enter a record number which exists in the program.
to record number	The record number to which numbering is to take place. “*99999*” is entered as the default, i.e. the program will be numbered to record N*99999*, that is to the end of the program. Transfer the default or enter a record number which exists in the program.
Step width	Enter the increment for the sequential record numbers. With step size “10” numbering will be e.g.: N010, N020, N030, etc.
starting with no.	Enter here the record number at which numbering is to start.

5.1.2 Position list and register

When programming you can either specify positions directly (e.g. X100) or specify the values by position register. You simply specify the desired position register (e.g. X@1) in the program.

Please note
As from operating system version 4.6, position registers (@n) can also be used for saving various other values, see section 5.3.3.

You can display the position register through the position list in WinPISA. The position registers of all axes are combined under the same index and given a name as a symbolic position in the position list.

You can use the name of the symbolic position in user programs instead of specifying position registers (e.g. the positions “X@STORE_POS” and “Y@STORE_POS” with index “3” stand for the position registers X@3 and Y@3).

Fig. 5/4: Project window, software area

Position list window

The various positions are displayed as lines in a table in the position list window. Each line corresponds to a position. A position can therefore contain position values for the X, Y, Z and U axes.

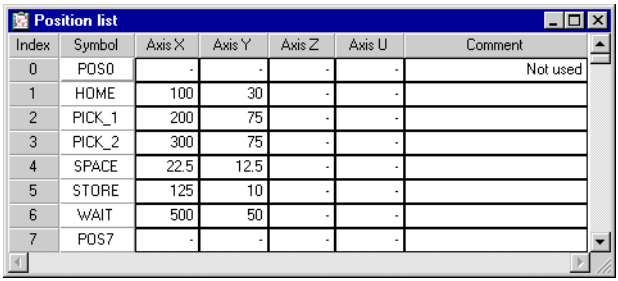


Fig. 5/5: Position list

The individual values are displayed as lines in a table in the position list window. Each line can contain values for the X, Y, Z and U axes.

Column	Contents
Index	Index of the symbolic position list entry. Corresponds to the number of the assigned position register.
Symbol	Symbolic identifier for the position list entry. Can be used in the user program instead of the corresponding value. Maximum 12 characters, no special signs, the first character must not be a figure.
Axis X	Value for the X-axis
Axis Y	Value for the Y-axis
Axis Z	Value for the Z-axis
Axis U	Value for the U-axis
Comment	Description of the position list entry

Processing the position list

Do not use any special characters or reserved command words when entering the symbolic identifier.

Editing the position list

To edit a field in the position list:

1. Move the selection (the frame) to the field you want to modify.
2. Press ENTER. The field will now be in edit mode (see status bar).
3. Enter the desired value in the field.
4. Confirm the entry with ENTER. The edit mode will be exited when a permitted entry is made.

Save modifications to the position list by selecting [Save] from the [File] menu or by clicking on the “Save active window” button in the toolbar when the position list window is active.

Use the decimal point as divider (e.g. 300.05) for entries in the position list.
Enter maximum 2 decimal positions.

Teaching the position

You can also specify positions in the position list using a Teach function in addition to a direct entry using the keyboard.

Caution
Axes in the system will start to move when this function is activated.

Make sure that it is only possible to reach into the positioning range of the axes when the system is depressurized.

Control signals required:
1-signal at ENABLE, STOP and READY.

To accept axis positions into the position list:

1. Activate Online mode by selecting [Online mode] from the [Online] menu or by clicking on the “Online mode on” button in the toolbar.
2. Select [Teach position] from the [Edit] menu.
3. Read the warning displayed. Click “Continue” to con-tinue the “Teach position” function; click “Cancel” to cancel the function.
4. Select the position for which you wish to accept the axis position under “Symbol name” from the “Teach position” dialogue window. The current values for the individual axes in the position list are displayed to the right of the “Symbol name” field.

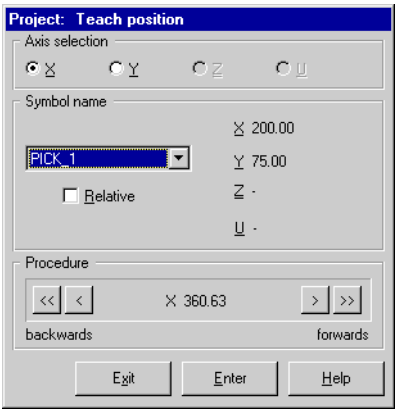


Fig. 5/6: Teach position

5. Select the axis for which you wish to teach a position.

6. Move the axis to the desired position using the buttons under “Procedure”. The current position is displayed under “Procedure”.
   The axis can also be moved manually when the compressed air is switched off.

Button	Moves the selected axis ...
< <	... continuously in a negative direction.
<	... by 2 x set positioning tolerance in a negative direction.
>	... by 2 x set positioning tolerance in a positive direction.
> >	... continuously in a positive direction.

7. To determine a relative position, move to a start po-sition and check the “Relative” check box under “Symbol name”. The position display under “Procedure” will be reset to the value “0.00” and in further movements of the axis will show the position relative to the start position.

8. Accept the position displayed under “Procedure” into the position list by pressing “Enter”.

Click “Exit” to close the dialogue window once you have determined the desired positions.

The command [Teach position] only changes the position list. Download the position list to the SPC200 or teach the position in the position register using [Optimize position] from the [Online] menu to modify the values in the position register.

5.2 General instructions on programming

You must take the following into account when creating NC programs:

– the operating mode in which you intend to use the SPC200.
  In Start/Stop mode all NC commands are supported. In Record Select mode only positioning commands, positioning conditions and commands for setting the positioning quality class are supported.

– the number of fixed starting programs.
  If a single or multi-axis system is controlled by an SPC200, only one starting program is usually defined. If two independent work stations are controlled, a separate starting program must be defined for each work station (autonomous operation of two work stations).

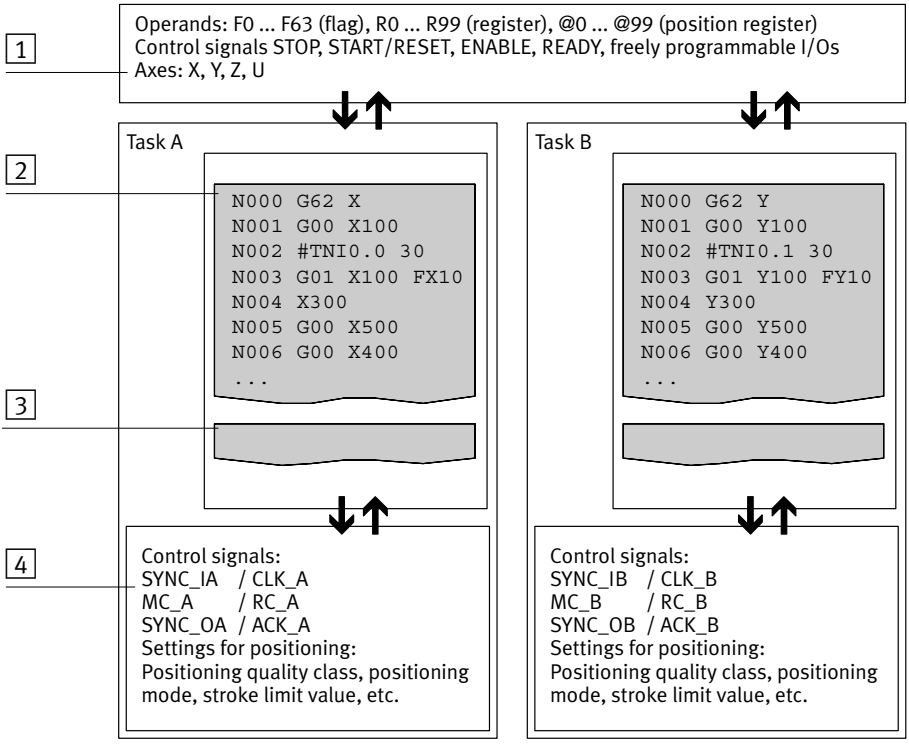
5.2.1 Parallel program processing

The SPC200 possesses amultitasking-capable operating system. This can process two tasks parallel. For parallel processing two programs must be defined as starting programs. These will then be processed parallel as task A and task B. Accessed sub-programs are processed instead of the relevant starting program, until the sub-program processing is completed and the starting program is continued.

The parallel program processing supports the low-cost implementation of two independent work stations with one SPC200. Therefore certain I/O control signals (e.g. MC_A and MC_B) and settings for positioning are managed task-specifically.

However, task A and task B provide together:

- the control signals STOP, START/RESET, ENABLE and READY
- the freely programmable I/Os (only in Start/Stop mode)
- the flags, registers and position registers
- the positioning axes. They are each assigned during the processing of a positioning command of the accessing task.



1 Commonly managed operands, control signals and axes

2 Starting program (here of task A)

3 Sub-programs (here of task A)

4 Task-specifically managed control signals and settings for positioning (see also chapter 5.2.3)

Fig. 5/1: Common and task-specific control signals and data

Please note
Please observe the following instructions when using the parallel program processing:

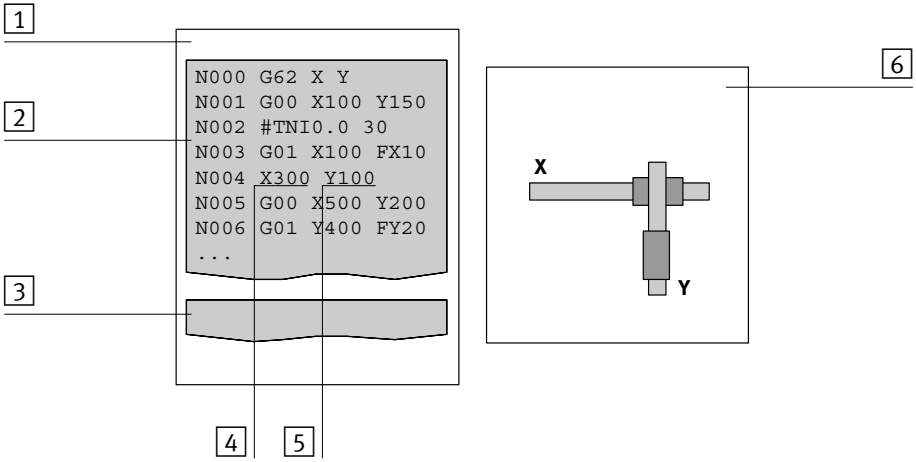
- The control signals STOP, START/RESET, ENABLE and READY as well as the freely programmable I/Os serve both tasks together.
- Flags, registers and position registers are managed commonly by both tasks.
- The control signals SYNC_.../CLK_..., MC_.../RC_... and where applicable ACK_... are managed separately by the relevant task (A or B).
- Settings for positioning are managed separately by each task (task-specific). All the presettings for positioning named in chapter 5.2.3 belong here.
- If a task accesses an axis, this axis will remain assigned until the relevant NC command has been processed or until the nominal position is reached. The axis will then be made available again.
- If a program wishes to access an assigned axis, it will remain in the waiting status until the axis is made available again.
  Exception 1:
  If the assigned axis processes an M10 or M39 command and another task tries to access the axis, an appropriate fault message will be triggered.
  Exception 2:
  The M12 command (Stop axes) will immediately stop all addressed axes, irrespective of the task which has assiged them. In such cases both tasks must be program-technically synchronized, e.g. by the setting and interrogating of flags.

Multi-axis operation

Coordinated operation

In coordinated operation of several axes, the possibility of parallel program processing is not usually used. Only one program is defined as the starting program. The positioning tasks for all axes are programmed in this program.

If a positioning task refers to all axes, it is not completed until all the axes have reached the target position. The movement sequence of all axes is thereby coordinated. The second starting program can be used for monitoring functions.



1 Task A

2 Starting program of task A

3 Sub-programs

4 Positioning command for the X-axis

5 Positioning command for the Y-axis

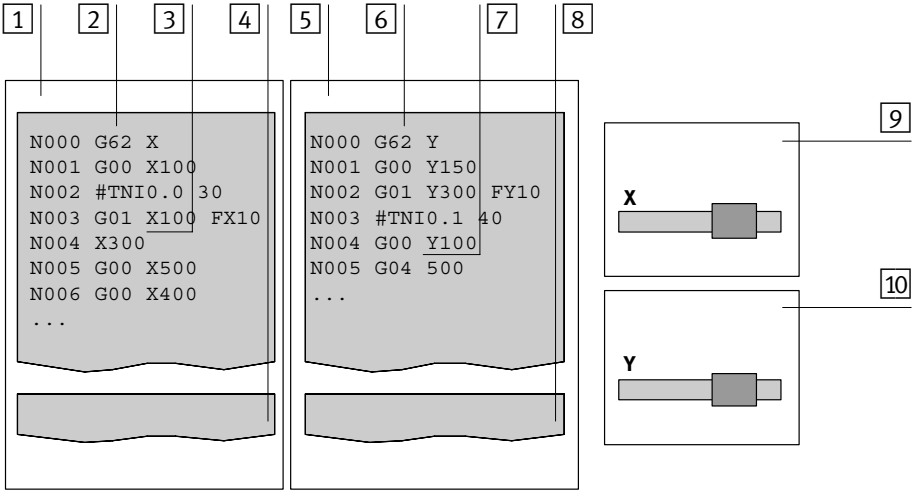
6 Work station A (two coordinated axes)

Fig. 5/2: Coordinated operation (example two-axis system)

Autonomous operation

In autonomous operation two independent work stations are controlled by one SPC200. For this special case, you must define two different programs as starting programs which are processed independently of each other (parallel).

The two parallel-running programs both have the output READY and the inputs ENABLE, STOP and START/RESET.



1 Task A

2 Starting program of task A

3 Positioning task for the X-axis

4 Sub-program of task A

5 Task B

6 Starting program of task B

7 Positioning task for the Y-axis

8 Sub-program of task B

9 Work station A (X-axis)

10 Work station B (Y-axis)

Fig. 5/3: Autonomous operation of two work stations (example)

In autonomous operation the program is processed independently for each work station. Each work station can be controlled independently of the other by means of the freely programmable I/Os (Start/Stop operation) or by the command I/Os (Record Select operation).

Please observe the following when using parallel program processing in autonomous operation:

– Starting programs must not be accessed as sub-programs.

– Sub-programs, which contain positioning commands, may only be used by one starting program.

5.2.2 Program organisation

When programming for the SPC200 you can:

– create up to 100 NC programs in the SPC200 with a maximum total of 2000 NC records

– enter up to 1000 NC records (i.e. 1000 program lines) in one single program

– access each NC program as a sub-program. Four nested sub-program calls are therefore possible.

5.2.3 Presetting for positioning

The following settings are effective when the SPC200 is switched on or after a program reset and are managed for each task (task A and task B) independently of each other:

Presettings for positioning	
G02 ... F...0	– With pneumatic drives: Move smoothly to position at defined speed (G02); speed factor = 100 %. – With stepping motor axes: Move to position at Start/Stop frequency
G08, G09	Acceleration for approach ramp and braking ramp = 100 %
G61	The positioning quality class (1...6) set in the application data is valid
G90	Absolute positioning
M10	For first commissioning with the control panel the following factory settings apply: – Channel no. for all axes: channel 1 – Acaling factor: 10.00 mm/V – Offset: 0.00 mm – Nominal value mode: 0 With commissioning in WinPISA, the presettings are defined for the relevant axis in the register card “Nominal value specification”.
M11	
M13	
M14	
M37 [1)]	Work item mass in basic status, see system manual for the SPC200 .
M40 [2)]	Stroke limit value: = ± 10.00 mm or ± 10.00 °
M41 [2)]	Speed limit value = 0.1 m/s or 100 °/s

1) This function is supported as from operating system version 4.82 only in conjunction with WinPISA as from version 4.41.
2) These commands are supported as from operating system version 4.6 only in conjunction with WinPISA as from version 4.3 (see also chapter 5.2.4).

5.2.4 New NC syntax and new NC commands

New feature
as from **OS 4.63**

The operating system version 4.6 of the SPC200 offers, in conjunction with WinPISA as from version 4.3, an extended scope of functions due to the support of new NC commands and extended NC syntax. Furthermore, as from operating system version 4.6, position registers (@n) can also be used for saving speed and acceleration values.

Please note
Programs which use the new NC commands and the extended NC syntax of operating system version 4.6 or higher **cannot** be displayed and **cannot** be edited with control panel type SPC200-MMI-1... .

New as from operating system version 4.6	
...Rn ...@n	The positioning speed (F...) can also be saved with the NC commands G01 and G02: – as percent value in a register (Rn) – as absolute value in a position register (@n). The acceleration can also be saved with the NC commands G08 and G09: – as percent value in a register (Rn) – as absolute value in a position register (@n). The preselect value can also be saved with the NC command G25: – as percent value in a register (Rn) – as absolute value in a position register (@n).
M10	The NC command M10 is now also permitted without a scaling factor.
M12	A preselect value defined with G25 can now be deleted with M12.
M39	New NC command: Output valve positioning value
M40	New NC command: Set stroke limit value for M39
M41	New NC command: Set speed limit value for M39
F64 ... F127	The axis status flags F64 ... F127 are reserved for internal status information, see chapter 5.3.6.

New feature
as from **OS 4.82**

The operating system version 4.82 of the SPC200 offers, in conjunction with WinPISA as from version 4.41, an extended scope of functions for considering the mass load, the nominal value specification as well as the support of the DNCI drive.

New as from operating system version 4.82	
...Rn ...@n	The mass value can also be saved with the NC command M37: – as percent value in a register (Rn) – as absolute value in a position register (X [Y Z U] @n). The parameters Scaling Factor and Offset can also be saved with the NC commands M10 and M11: – as absolute value in a position register (X [Y Z U] @n).
M14	Channel 5 has been introduced for the digital nominal value specification via the field bus
G74	Reference travel is required for the DNCI pneummatic drive. For this purpose, modes 0, 5, 6 and 7 have been introduced.

Detailed information can be found in the manual for the relevant NC commands in chapter 5.5.

5.3 Addressing, registers and axis status flags

The SPC200 knows different operators, variables and flags which can be used in the program for controlling a positioning sequence.

A distinction is made between 1-bit, integer and real variables; between remanent and non-remanent variables.
All the inputs and outputs of the SPC200 are treated like 1-bit variables.

5.3.1 Addressing

The following operands are supported:

Operand	Description	Address range	Value range
I	Input	I0.0 ... I13.15 [1]	0/1
Q	Output	Q0.0 ... Q13.15 [1]	0/1
F	Flag [2]	F0 ... F63	0/1
F	Axis status flag	F64 ... F127	0/1
R	Register [2]	R0 ... R99	-32768...+32767
@	100 position register per axis [2]	@0...@99 [3]	*-9999.98...+9999.99* [4]

1) Available address range see following table
2) These operands are saved and protected against power failure (remanent)
3) In the case of programming with WinPISA, symbolic names for positions can also be used (e.g. X@ABLAGE_POS). These are replaced by the position register numbers during Download.
4) The control panel the value *-9999.99* (smallest permitted position value) with unused position registers.

I/O address range

The assignment of the I/O address range depends on the configuration of the SPC200. If a field bus module is fitted, the address range will remain 0.0 ... 0.9 unassigned. The assignment of the I/O addresses for configuration with and without field bus module is shown in the following table:

Configuration without field bus module	**Configuration with field bus module**	**Max. address range**	
First I/O module	– [1]	I0.0 ... I0.9 [1] [2]	Q0.0 ... Q0.7 [1] [2]
I/O module on the first axis interface string		I1.0 ... I1.15	Q1.0 ... Q1.15
Second I/O module	**First** I/O module	I2.0 ... I2.9	Q2.0 ... Q2.7
I/O module on the second axis interface string		I3.0 ... I3.15	Q3.0 ... Q3.15
Third I/O module	**Second** I/O module	I4.0 ... I4.9	Q4.0 ... Q4.7
Fouth I/O module	**Third** I/O module	I5.0 ... I5.9	Q5.0 ... Q5.7
– [3]	Field bus module	I10.0 ... I13.15 [2] [3]	Q10.0 ... Q13.15 [2] [3]

[1] Address range is not available if a field bus module is used
[2] Control inputs and outputs are reserved by pre-assigned functions
[3] Address range is not available without a field bus module

5.3.2 Addressing the control signals

Record Select mode

Control signal	I/O module addresses	Address with fieldbus	Description
ENABLE	I0.9	I10.0	Controller enable (1 = controller enabled)
RESET	I0.8	I10.1	Reset programs (in conjunction with STOP=0)
STOP	I0.7	I10.2	Stop positioning task (0 = stopped)
CLK_A/B	I0.6 / I0.5	I10.3 / I10.4	Start NC record from program A/B
RECBIT1...5	I0.0 ... I0.4	–	Bits for NC record number: RECBIT1 for2^0 etc. (record bit)
RECBIT...	–	I11.0 ... I11.15	RECBIT... with control via a field bus module as 2-byte value from 0 to 999, see manual on the field bus module.
READY	Q0.7	Q10.0	System ready to operate
ACK_A/B	Q0.6 / Q0.5	Q10.1 / Q10.2	Task accepted for program A/B (acknowledge)
RC_A/B	Q0.4 / Q0.3	Q10.3 / Q10.4	NC record concluded by program A/B (record complete)

Start-stop mode

Control signal	I/O module addresses	Address with fieldbus	Description
ENABLE	I0.9	I10.0	Controller enable (1 = controller enabled)
START/RESET	I0.8	I10.1	Start/continue or reset programs (RESET in conjunction with STOP=0)
STOP	I0.7	I10.2	Stop program sequence (0 = stopped)
SYNC_IA/IB	I0.6 / I0.5	I10.3 / I10.4	Synchronization input for M00
READY	Q0.7	Q10.0	System ready to operate
SYNC_OA/OB	Q0.6 / Q0.5	Q10.1 / Q10.2	Synchronization output for M00
MC_A/B	Q0.4 / Q0.3	Q10.3 / Q10.4	MC output for program A/B (motion complete)

5.3.3 Position register X [Y Z U] @n

The SPC200 provides 100 position registers per axis.
They have the identifier X [Y Z U] @n {n=0...99}, are decimal values with 2 decimal positions between -9999.98 and +9999.99.
Position registers are saved remanently, i.e. they are saved in the event of Power-off and loaded back into the work memory with Power-on.

The registers can be parametrized with the MMI and WinPISA (with the position list), whereby the notes regarding limitation on page XVI should be observed.

The registers can be modified within a program or via the field bus [1], i.e. they can be read and overwritten.

New feature as from **OS 4.63**

[1] For PROFIBUS this applies only as from operating system version 4.63 together with the PROFIBUS software version 2.0. For DeviceNet as from operating system 4.90 together with the software version as from 2.01 (DN2). Interbus does not permit this feature.

The position registers are used in conjunction with the following NC commands for influencing the movement features of a positioning axis.

NC command	Function	The register contents may be	Unit [1]	Ss from operating system
G00	Positioning command	Position	mm	3.8
G01 G02	Positioning command	Position	mm	3.8
		Speed	m/s	4.63
G08	Positioning parameter	Acceleration	m/s^2	4.63
G09	Positioning parameter	Acceleration	m/s^2	4.63
G90	Positioning parameter [2]	Position	mm	3.8
G91	Positioning parameter [2]	Position	mm	3.8

[1] With rotary drives correspondingly °, 10^3 °/s, 10^3 °/s^2
[2] With position specification functions as positioning command

NC command	Function	The register contents may be	Unit [1]	As from operating system version
G25	Switch to next record	Position	mm	4.63
G28 G29 M38	Register operation	After defining	mm	3.8
			m/s	4.63
			m/s^2	4.63
M40	Positioning parameter	Limit value	mm	4.63
M41	Positioning parameter	Limit value	m/s	4.63
M37	Positioning parameter	Tool load or mass moment of inertia	Kg $Kgm^2 * 10^{-4}$	4.82
M10	Positioning command	Scaling factor	mm/V	4.82
M11	Positioning parameter	Offset value	mm	4.82
[1] With rotary drives correspondingly °, °/s, $°/s^2$				

5.3.4 Register Rn

In the SPC200 100 R-registers can be used within the programs. They have the identifier Rn {n=0...99}, are integer variables and can accept values from -32768 ... +32767.
R-registers are saved remanently, i.e. they are saved in the event of Power-off and loaded back into the work memory with Power-on.
The registers can be parametrized with the MMI and WinPISA, whereby the limiting instructions on page XVI must be observed.

These registers can be modified within a program or via the field bus [1], i.e. they can be read and overwritten.

R-registers must be initialized within a program or via the field bus (assign starting value).

New feature as from **OS 4.63**

[1] For PROFIBUS this applies only as from operating system version 4.63 together with the PROFIBUS software version 2.0. For DeviceNet as from operating system 4.90 together with the software version as from 2.01 (DN2). Interbus does not permit this feature.

The R-registers are used in conjunction with the following NC commands for influencing the movement features of a positioning axis or the control of the program sequence.

NC command	Function	The register contents may be	Unit	As from operating system version
G01	Positioning command	Speed	% value	3.8
G02	Positioning command	Speed	% value	3.8
G08	Positioning parameter	Acceleration	% value	3.8
G09	Positioning parameter	Acceleration	% value	3.8
G25	Switch to next record	Position	% value	3.8
M39	Positioning command [1]	Valve setting value	% value	4.63
M37	Positioning parameter	Tool load	% value	4.82
L	Sub-program	Program number	–	3.8
E05	Jump address	Record number	–	3.8
#LR	Register operation	Integer value	–	3.8
#TR	Register operation	Integer value	–	3.8
#AR	Register operation	Integer value	–	3.8

[1] By direct influence of the valve setting value functions as a positioning command

5.3.5 Flag Fn

In the SPC200 64 flags can be used for controlling the program sequence. They have the identifier Rn {n=0...63}, are 1-bit variables and can accept the values 0 or 1.
Flags are saved remanently, i.e. they are saved in the event of Power-off and loaded back into the work memory with Power-on.
The flags can be read and overwritten with the MMI and WinPISA.

The flags can be modified within a program or via the field bus [1], i.e. they can be read and overwritten.

New feature as from **OS 4.63**

[1] For PROFIBUS this applies only as from operating system version 4.63 together with the PROFIBUS software version 2.0. For DeviceNet as from operating system 4.90 together with the software version as from 2.01 (DN2). Interbus does not permit this feature.

The flags are used in conjunction with the following NC commands for influencing the program sequence.

NC command	Function	Register contents	As from operating system version
#S	Set flag	1	3.8
#R	Reset flag	0	3.8
#T	Test flag	1 or 0	3.8
#TN	Test flag	1 or 0	3.8

5.3.6 Axis status flag Fn

New feature
as from **OS 4.63**

The SPC200 generates various status flags for its internal monitoring. These are dynamic variables which are modified dynamically depending on the positioning procedure and represent a certain status of the axes.
They have the identifier Fn {n=64...127}. They are 1-bit variables and can accept the values 0 or 1.

Status flags are not saved remanently like flags.

The status flags can be used like 1-bit variables by a running program in the SPC200, i.e. they can be read. They are used in conjunction with the following NC commands for influencing the program sequence.

NC command	Function	Register contents	as from operating system version
#T	Test flag	1 or 0	4.63
#TN	Test flag	1 or 0	4.63

Axis status flags (flags 64 ... 87)

Name	Meaning	Flag number of the axis			
		X	Y	Z	U
REF	Reference set	64	65	66	67
MC	Motion Complete	72	73	74	75
TOL	Axis in the tolerance window	80	81	82	83
MOV	Axis moves	84	85	86	87

Description of the axis status flag

REF – Reference set	The flag indicates that reference travel has been carried out successfully. Details on reference travel are described in command G74. The flags have the numbers F64 ... F67, according to the table above.
MC – Motion Complete	The flag shows the status of a positioning task of an axis. If the bit is set, the last positioning task is completed. Details can be found in chapter 5.2.1. The flags have the numbers F72 ... F75, according to the table above.
TOL – Axis is in the tolerance window	The flag is set when the axis moves into the specified tolerance window or is in this window. When it leaves the tolerance window it will be reset. The tolerance window corresponds to the positioning tolerance and is defined in the application data when an axis is planned, see chapter 4.3. The flags have the numbers F80 ... F83, according to the table above.
MOV – Axis moves	The flag is set as soon as the axis moves and is reset as soon as the axis stops. The switching threshold between standing still and moving lies at 4 mm/s. The flags have the numbers F84 ... F87, according to the table above.

New feature as from **OS 4.90**

System status flags (flags 88 ... 95)

The system status flags show non axis-dependant states of the SPC200.

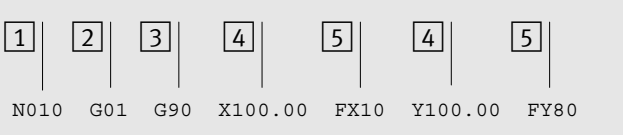
Flag number	Meaning
88	Status task A: 0 = Program in sub-system A is not running 1 = Program in sub-system A is running
89	Status task B: 0 = Program in sub-system B is not running 1 = Program in sub-system B is running
90 ... 95	reserved

5.4 Command syntax

The programs for the SPC200 are based on the syntax as per DIN 66025.

An NC record consists of a record number as well as an NC command with the relevant parameters.

Example:



1 Record number

2 NC command

3 Type of positioning (optional)

4 Positioning

5 Parameters

Fig. 5/4: Example NC record

Record numbers

Each NC record is marked with a record number. Record numbers begin with the letter N (for NC record number).

In the SPC200 the record numbers are numbered beginning with N000 and a step size of 1 (therefore N000, N001, N002, ...).

The record numbers can be numbered as desired in ascending order in WinPISA.
Fixed jump targets are adapted accordingly when the programs are translated and loaded into the SPC200. Take this into account when specifying jump targets by register (commands E05, #T, #TN, #TR).

Identifiers

The following identifiers are used during the NC programming of the SPC200:

Identifier	Description
N	Identifier for record numbers
G	Path conditions
M	Help functions
E	Jump functions
L	Sub-program call
#	Single-bit and multibit operations
X, Y, Z, U	Axis conditions: X-axis, Y-axis, etc.
F	Positioning speed
;	Start of comment, valid until end of line *)
.	Decimal divider (point)
*) Only for programming with WinPISA	

In NC programs the point is used as decimal divider (e.g. X300.50).

Overview of commands

The following characters are used in the overview tables for explaining the syntax:

Identifier	Description
`[..]`	Parameters listed in brackets can be specified as an alternative or additionally [1]
`..|..`	Parameters separated by vertical lines can be specified as an alternative
`n`	Wildcard for numerical values
`<WILDCARD>`	Wildcard e.g. for: – operands (e.g. Q0.0) – positions – speeds – acceleration – etc.

[1] In order to facilitate reading, axis identifiers are shown in simple form ([Y.., Z.., U..]). Additional parameters have been left out intentionally.

The following table contains an overview of the NC commands arranged according to theme.

Command	Description and syntax	
Positioning commands (permitted in Start/Stop and Record Select modes)		
G00	Move to position at highest possible speed	
	`G00 [G90|G91] X<Position> [Y.., Z.., U..]`	
G01	Move to position at defined speed	
	`G01 [G90|G91] X<Position> FX<Speed> [Y.., Z.., U..]`	
G02	Pneumatic axis: Move smoothly to position at defined speed Stepping motor axis: Move to position at Start/Stop frequency	
	`G02 [G90|G91] X<Position> FX<Speed> [Y.., Z.., U..]`	
—	Move to position in last positioning mode	`X<Position> [Y.., Z.., U..]`
G74	Start reference travel	`G74 X<Mode> [Y.., Z.., U..]`
Positioning commands (permitted in Start/Stop and Record Select modes)		
G08	Pneumatic axis: Acceleration for approach ramp Stepping motor axis: Acceleration for approach ramp and braking ramp	
	`G08 X<Acceleration> [Y.., Z.., U..]`	
G09	Pneumatic axis: Acceleration for braking ramp	
	`G09 X<Acceleration> [Y.., Z.., U..]`	
G90	Absolute dimension specification	`G90 X<Position> [Y.., Z.., U..]`
G91	Relative dimension specification	`G91 X<Position> [Y.., Z.., U..]`
Position register (permitted in Start/Stop mode)		
G28	Load position value into the position register	`G28 @<Target> X<Source> [Y.., Z.., U..]`
G29	Add position value and position register	`G29 @<Target> X<Source> [Y.., Z.., U..]`
M38	Load actual value into the position register	`M38 @<Register> X [Y, Z, U]`

Com-mand	Description and syntax	
Sequence control (permitted in Start/Stop mode)		
G04	Dwell time	G04 <Dwell time>
G25	Position-dependent switch to next record	G25 X<Preselect> [Y.., Z.., U..]
E05	Unconditional jump	E05 <Record number>
L	Call sub-program	L<Program number>
M00	Programmed stop	M00
M02	Sub-program end	M02
M30	Program end with repeat	M30
M12	Deactivate axis stop / nominal value input	M12 X [Y, Z, U]
Positioning quality (permitted in Start/Stop and Record Select modes)		
G60	Pneumatic axis: Exact stop without damping time	G60 X [Y, Z, U]
G61	Pneumatic axis: Set positioning quality class	G61 X<Quality class> [Y.., Z.., U..]
G62	Pneumatic axis: Fast stop without damping time	G62 X [Y, Z, U]
Analogue and digital nominal value specification (permitted in Start/Stop mode)		
M10	Activate nominal value input	M10 X<Factor> [Y.., Z.., U..]
M11	Offset for analogue nominal value specification	M11 X<Offset> [Y.., Z.., U..]
M13	Set nominal value mode	M13 X<Mode> [Y.., Z.., U..]
M14	Assign nominal value inputs	M14 X<Input> [Y.., Z.., U..]

Command	Description and syntax	
Valve positioning value (permitted in Start/Stop mode)		
M39	Pneumatic axis: Output valve positioning value	`M39 X<Positioning value> [Y.., Z.., U..]`
M40	Pneumatic axis: Set stroke limit value	`M40 X<Limit value> [Y.., Z.., U..]`
M41	Pneumatic axis: Set speed limit value	`M41 X<Limit value> [Y.., Z.., U..]`
Bit operations (permitted in Start/Stop mode)		
#S	Set single-bit operand	`#S<Operand>`
#R	Reset single-bit operand	`#R<Operand>`
#T	Test single-bit operand for 1-signal	`#T<Operand> <Record number>`
#TN	Test single-bit operand for 0-signal	`#TN<Operand> <Record number>`
Register operations (permitted in Start/Stop mode)		
#LR	Load register	`#LR<Register> = <Value>`
#AR	Add to register	`#AR<Register> = <Value>`
#TR	Test register	`#TR<Register> = <Value> <Record number>`
Special commands (permitted in Start/Stop mode)		
M37	Pneumatic axis: Set mass assessment	`M37 X<Mass> [Y.., Z.., U..]`

5.5 Explanation of the NC commands

Identifying supported NC commands

Operating mode

In Start/Stop mode all NC commands are supported. NC commands, which are supported in the Record Select mode, are marked as follows:

– permitted in operating mode: Start/Stop, Record Select

Axis type

If the description refers to a particular axis type, this is also marked.This means:

Axis type	Description
– Pneumatic axis	The description of the NC command refers to the pneumatic drives
– Stepping motor axis	The description of the NC command refers to the stepping motor axes

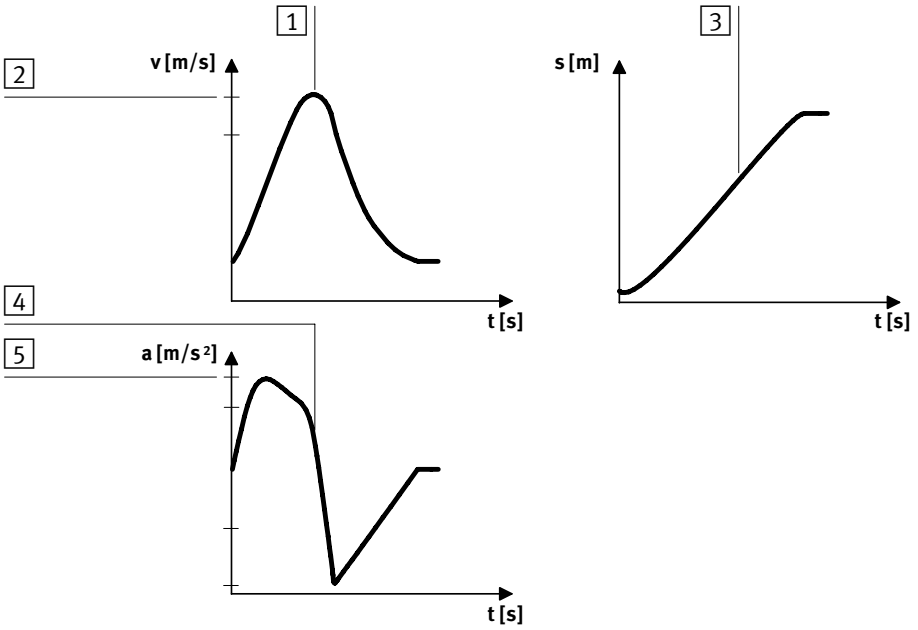
If no identification is given for a particular axis type, the command description for both axis types is valid.

G00	**Move to position at highest possible speed (point to point)** – pneumatic axis; – permitted in operating mode: Start/Stop, Record Select		
`Nn G00 [G90|G91] X<Position> [Y.., Z.., U..]`			
`<Position>`	`n`	Position in [mm] or [°]	n = ±*9999.99*
	`@n`	Position in [mm] or [°] saved in the position register @n	n = 0 ... *99*
Effect	The pneumatic drive moves as fast as possible from the current position to the defined position (absolute or relative, see under G90/G91). The automatically generated nominal values for speed and acceleration are limited to the maximum values ascertained during the system identification, in order e.g. to avoid overswing due to stressing (see Fig. 5/5).		
Example	`N000 G00 G91 X100` ;Move 100 mm in a positive direction `N001 G00 G90 X@2` ;Move to position from position register 2 ;of the X-axis `N003 G00 X100 Y-100` ;Move to X100 and Y-100 `N004 G00 X@5 Y@1` ;Move to position from position register 5 (X) ;and position register 1 (Y)		

Remark	Absolute positioning (G90) is preset when the system starts.
	Command G00 has a saving effect. It remains effective until it is cancelled by command G01 or G02. Example:
	`N000 G00 X100`
	`N001 X200`
	`N002 G01 X300 FX10`
	With WinPISA programming, positions can also be specified symbolically. For this purpose, the position values and position names are entered in the position list. Example:
	`N006 G00 X@ABHOL_POS`
	`N007 X@ABLAGE_POS`		

Command G00 can only be used after successful system identification, i.e. after static and dynamic identification travel. Nominal value sequences for path, speed and acceleration, which enable reproducible, as fast as possible and overswing-free approach to the nominal position, are specified by the SPC200. The maximum speed and acceleration configured in the application data have no effect with command G00.

Fig. 5/5 shows as an example the time sequence of the nominal value specification.



1 Nominal speed value

2 Identified maximum speed

3 Nominal position value

4 Nominal acceleration value

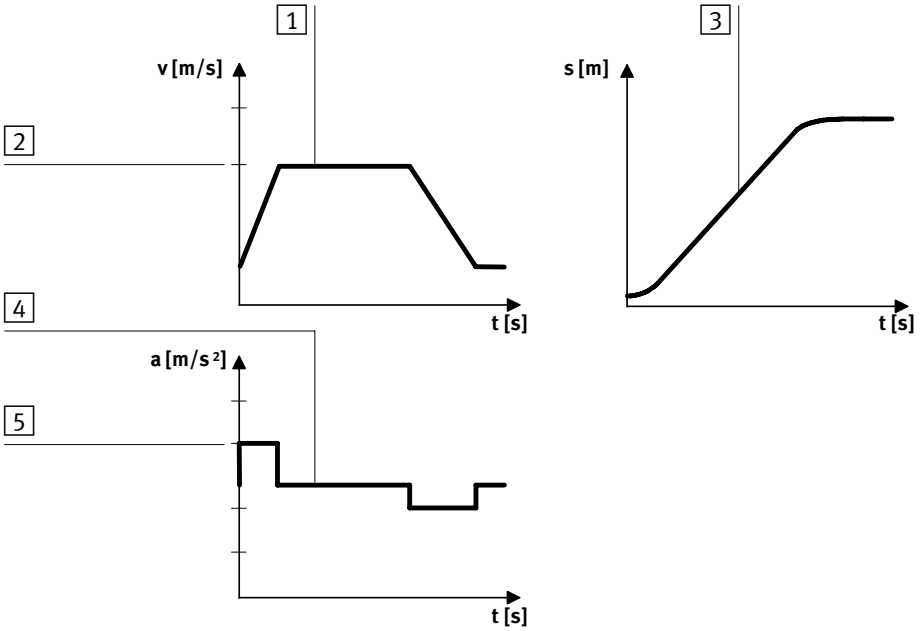
5 Identified maximum acceleration

Fig. 5/5: Nominal value specification with command G00 (pneumatic axis)

Speed and acceleration can only be specified directly with the positioning commands G01 and G02. If no dynamic identification travel can be carried out due to application-specific reasons, only the positioning commands G01, G02 or M10 are permitted.

G00	**Move to position at highest possible speed (point to point)** – stepping motor axis; – permitted in operating modes: Start/Stop, Record Select		
`Nn G00 [G90|G91] X<Position>  [Y.., Z.., U..]`			
`<Position>`	`n`	Position in [mm]	n = ±*9999.99*
	`@n`	Position in [mm] saved in the position register @n	n = 0 ... *99*
Effect	The stepping motor axis moves at the maximum speed and maximum acceleration specified in the application data from the current position to the defined position (absolute or relative, see under G90/G91).		
Example	As with the pneumatic axes (see under G00 for pneumatic axis)		
Remark	As with the pneumatic axes (see under G00 for pneumatic axis)		

With the stepping motor axis, the nominal speed value rises with command G00 at first in ramp form, until the maximum speed specified in the application data is reached. Before the nominal position is reached, the nominal speed value drops in ramp form again. The steepness of the approach and braking ramps is preset by the maximum acceleration defined in the application data.



1 Nominal speed value

2 Configured maximum speed

3 Nominal position value

4 Nominal acceleration value

5 Configured maximum acceleration

Fig. 5/6: Nominal value specification with command G00 (stepping motor axis)

G01	**Move to position at defined speed (nominal value ramp)** – permitted in operating modes: Start/Stop, Record Select

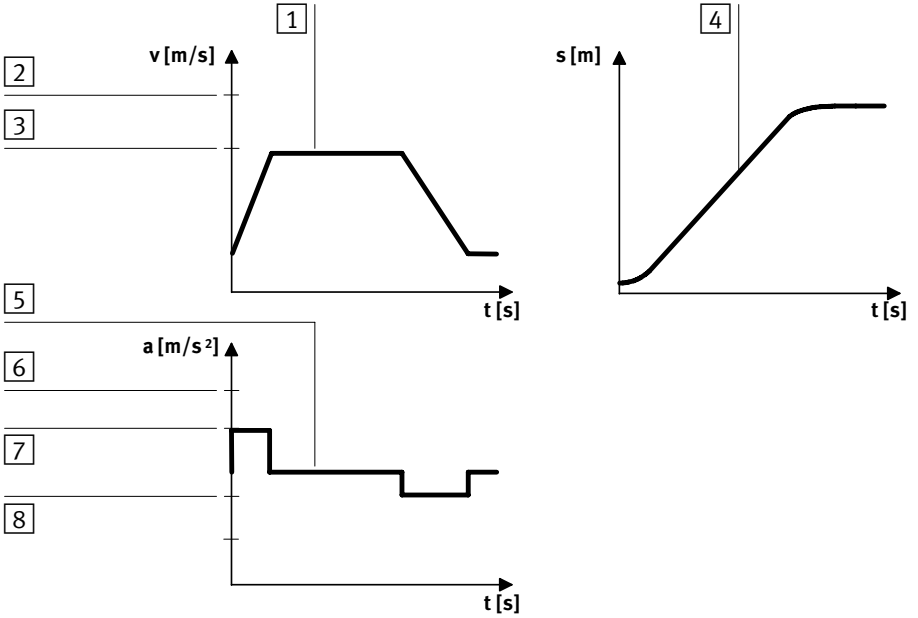
`Nn G01 [G90|G91] X<Position> FX<Speed> [Y.., Z.., U..]`

`<Position>`	`n`	Position in [mm] or [°]	n = ±*9999.99*
	`@n`	Position in [mm] or [°] saved in the position register @n	n = 0 ... *99*
`<Speed>`	`n`	Positioning speed in % of the configured maximum speed; 0 = 100 %, 1 = 1 % ... *99* = *99* %	n = 0 ... *99*
	`Rn` 1)	Positioning speed in % of the configured maximum speed saved in register Rn	n = 0 ... *99*
	`@n` 1)	Absolute value of the positioning speed in [m/s] or [10^3 °/s] saved in position register @n; permitted: 0.01 ≤ Speed ≤ Configured maximum speed	n = 0 ... *99*

Effect	The drive moves at the defined speed and acceleration from the current position to the defined position (absolute or relative), see Fig. 5/7. **Notes for pneumatic drives:** The following applies with pneumatic drives: The programmed nominal values for speed and acceleraion are limited, if necessary, automatically to the maximum values ascertained during the dynamic identification travel. This is to prevent the axis from overswinging due to high nominal values. If dynamic identification is not carried out, the maximum permitted values for acceleration must be ascertained by the user.
Example	`N000 G01 X100 FX10` ;Move to position 100 at 10 % of the ;configured maximum speed `N001 G01 X@2 FX@3` ;Move to position 2 from register @2 at the ;speed from register @3
Remark	`The following are preset when the system starts:` – positioning mode = absolute positioning (G90) – approach ramp = 100 % of the maximum acceleration (G08) – braking ramp = 100 % of the maximum acceleration (G09). Command G01 has a saving effect. It remains effective until it is cancelled by command G00 or G02. With WinPISA programming, positions can also be specified symbolically. For this purpose, the position values and position names are entered in the position list. Example see G00.

1) This syntax is only available as from operating system version 4.6. Programs which contain this syntax cannot be edited with control panel type SPC200-MMI-1... .

With command G01 the nominal speed value rises at first in ramp form until the maximum positioning speed programmed with FX or FY, FU or FZ is reached. Before the nominal position is reached, the nominal speed value drops in ramp form again. The steepness of the approach and braking ramps is preset by the maximum acceleration configured in the application data. With the commands G08 ad G09 you can specify the steepness of the ramps by program independently of each other.



1 Nominal speed value

2 Configured maximum speed

3 Programmed speed

4 Nominal position value

5 Nominal acceleration value

6 Configured maximum acceleration

7 Prog. acceleration for approach ramp (G08)

8 Prog. acceleration for braking ramp (G09)

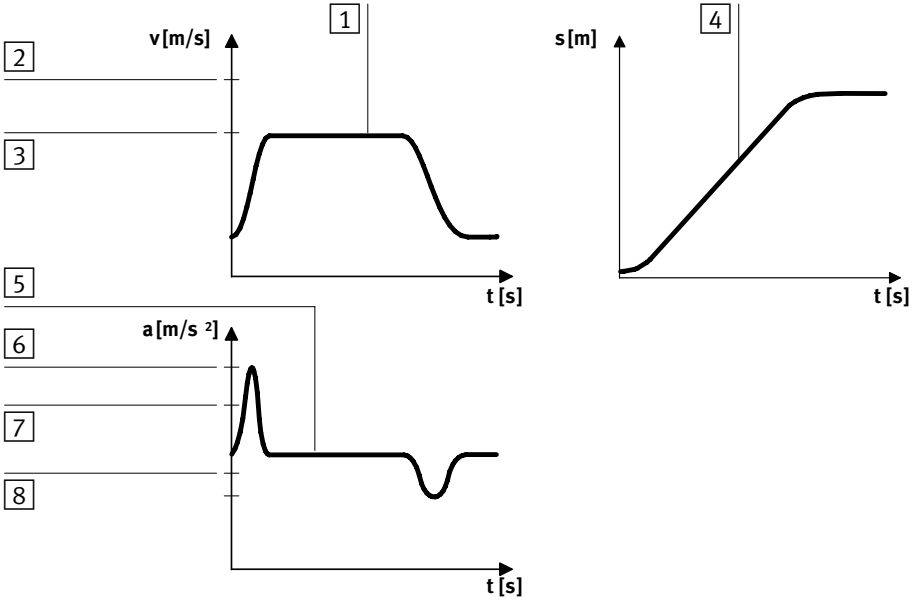
Fig. 5/7: Nominal value specification with command G01

G02	**Move smoothly to position at defined speed** – pneumatic axis; – permitted in operating mode: Start/Stop, Record Select		
`Nn G02 [G90|G91] X<Position> FX<Speed> [Y.., Z.., U..]`			
`<Position>`	`n`	Position in [mm] or [°]	n = ±*9999.99*
	`@n`	Position in [mm] or [°] saved in the position register @n	n = 0 ... *99*
`<Speed>`	`n`	Positioning speed in % of the configured maximum speed; 0 = 100 %, 1 = 1 % ... *99* = *99* %	n = 0 ... *99*
	`Rn` [1]	Positioning speed in % of the configured maximum speed saved in register Rn	n = 0 ... *99*
	`@n` [1]	Absolute value of the positioning speed in [m/s] or [10^3 °/s] saved in position register @n; permitted: 0.01 ≤ Speed ≤ Defined maximum speed	n = 0 ... *99*
Effect	The drive moves smoothly at the defined speed and acceleration from the current position to the defined position (absolute or relative). The programmed nominal acceleration values are to be understood as medium values (see Fig. 5/8). With regard to the programmed nominal values and acceleration, you must observe the **instructions for pneumatic drives with command G01**.		
Example	`N010 G02 X90 FX0` ;Move to position X90 at 100 % of the ;defined maximum speed `N011 G02 X@2 FX30` ;Move to position 2 from register @2 at 30 % of ;the defined maximum speed		
Remark	With this command sudden movements of the slide when arriving and braking can be reduced. The following are preset when the system starts: – Absolute positioning (G90) – Approach ramp = 100 % of the maximum acceleration (G08) – Braking ramp = 100 % of the maximum acceleration (G09). Command G02 has a saving effect. It remains effective until it is cancelled by command G00 or G01. With WinPISA programming, positions can also be specified symbolically. For this purpose, the position values and position names are entered in the position list. Example: `N010 G02 X@ABHOL_POS FX20 Y@ABHOL_POS FY30`		

[1] This syntax is only available as from operating system version 4.6. Programs which contain this syntax cannot be edited with control panel type SPC200-MMI-1... .

With command G02 the nominal acceleration value has a $\sin^2$-shaped curve. In this way, sudden modifications of the positioning signal and thereby sudden movements of the slide when arriving and braking can be reduced.

As with command G01, the nominal speed value rises at maximum to the programmed speed. The programmed nominal acceleration values of the approach and braking phases are however to be understood as medium values. The peak values lie by the factor 2 higher in order to achieve the same nominal positioning times as with G01.



1 Nominal speed value

2 Configured maximum speed

3 Programmed speed

4 Nominal position value

5 Nominal acceleration value

6 Effective nominal acceleration value

7 Prog. acceler. for approach ramp (G08)

8 Prog. acceler. for braking ramp (G09)

Fig. 5/8: Nominal value specification with command G02 (pneumatic axis)

G02	**Move to position at Start/Stop frequency** – stepping motor axis; – permitted in operating modes: Start/Stop, Record Select		
`Nn G02 [G90|G91] X<Position> FX<Speed> [Y.., Z.., U..]`			
`<Position>`	`n`	Position in [mm]	n = ±*9999.99*
	`@n`	Position in [mm] saved in the position register @n	n = 0 ... *99*
`<Speed>`	`n` `Rn` [1] `@n` [1]	Reserved; the parameter must be specified, but it is ignored	n = 0 ... *99*
Effect	The stepping motor axis moves at the configured Start/Stop frequency from the current position to the defined position (absolute or relative).		
Example	`N010 G02 X90 FX0` ;Move to position X90 at the Start/Stop ;frequency `N011 G02 X@2 FX0` ;Move to position from register 2 ;at Start/Stop frequency `N012 X100` ;Move to position 100 at the Start/Stop ;frequency		
Remark	A parameter F... must be specified in order to avoid syntax faults. The parameter value is however ignored, as positioning is made at Start/Stop frequency. Also ignored is the approach and braking ramp defined with G08 and G09. The following are preset when the system starts: – absolute positioning (G90). Command G02 has a saving effect. It remains effective until it is cancelled by command G00 or G01. With WinPISA programming, positions can also be specified symbolically. For this purpose, the position values and position names are entered in the position list. Example: `N010 G02 X@ABHOL_POS FX20 Y@ABHOL_POS FY30`		

[1] This syntax is only available as from operating system version 4.6. Programs which contain this syntax cannot be edited with control panel type SPC200-MMI-1... .

G04	**Dwell time** – permitted in operating modes: Start/Stop		
`Nn G04 <Dwell time>`			
`<Dwell time>`	`n`	Dwell time in 10 ms	n = 1 ... *9999*
Effect	Switching to the next NC record is not made until the dwell time has expired.		
Example	`N010 G00 X100` ;Move to position X100 `N011 G04 250` ;Wait 2.5 seconds `N012 G00 X200` ;Move to position X200		

G08	**Acceleration for approach ramp** – pneumatic axis; – permitted in operating mode: Start/Stop, Record Select		
`Nn G08 X<Acceleration> [Y.., Z.., U..]`			
`<Acceleration>`	`n`	Acceleration in %-steps of the configured maximum acceleration; 0 = 100 %, 1 = 1 % ... *99* = *99* %	n = 0 ... *99*
	`Rn` [1]	Acceleration in %-steps of the configured maximum acceleration saved in register Rn; 0 = 100 %, 1 = 1 % ... *99* = *99* %	n = 0 ... *99*
	`@n` [1]	Absolute value of the acceleration in [m/s^2] or [$10^3\,°/s^2$] saved in position register @n; permitted: 0.01 ≤ @n ≤ defined maximum acceleration	n = 0 ... *99*
Effect	With the following commands positioning is carried out at maximum with the acceleration specified here: – G01 and G02		
Example	`N020 G08 X50 Y50` ;Approach ramp = 50 % `N021 G01 X80 FX50` ;Move to position X80 `N022 G08 X0` ;Approach ramp with maximum acceleration The X-axis is accelerated when approaching position X80 by only 50 % of the configured maximum acceleration. The acceleration for the X-axis is then switched to maximum acceleration.		
Remark	This command has a saving effect. It remains effective until a new approach ramp is defined.		

[1] This syntax is only available as from operating system version 4.6. Programs which contain this syntax cannot be edited with control panel type SPC200-MMI-1... .

G08	**Acceleration for approach ramp and braking ramp** – stepping motor axis; – permitted in operating modes: Start/Stop, Record Select		
`Nn G08 X<Acceleration> [Y.., Z.., U..]`			
`<Accelera-tion>`	`n`	Acceleration in %-steps of the configured maximum acceleration; 0 = 100 %, 1 = 1 % ... *99* = *99* %	n = 0 ... *99*
	`Rn` [1]	Acceleration in %-steps of the configured maximum acceleration saved in register Rn; 0 = 100 %, 1 = 1 % ... *99* = *99* %	n = 0 ... *99*
	`@n` [1]	Absolute value of the acceleration in [m/s²] or [10^3 °/s²] saved in position register @n; permitted: 0.01 ≤ @n ≤ defined maximum acceleration	n = 0 ... *99*
Effect	With the following command the stepping motor is moved and braked at maximum with the acceleration specified here: – G01		
Example	`N020 G08 X50 Y50` ;Approach ramp and braking ramp = 50 % `N021 G01 X80 FX50` ;Move to position X80 `N022 G08 X0` ;Approach ramp and braking ramp with ;maximum acceleration The X-axis is accelerated and braked when approaching position X80 by only 50 % of the configured maximum acceleration. The acceleration for the X-axis is then switched to maximum acceleration.		
Remark	This command has a saving effect. It remains effective until a new approach ramp and braking ramp is defined.		

[1] This syntax is only available as from operating system version 4.6. Programs which contain this syntax cannot be edited with control panel type SPC200-MMI-1... .

G09	**Acceleration for braking ramp** – pneumatic axis; – permitted in operating mode: Start/Stop, Record Select		
`Nn G09 X<Acceleration> [Y.., Z.., U..]`			
`<Accelera-tion>`	`n`	Acceleration in %-steps of the configured maximum acceleration; 0 = 100 %, 1 = 1 % ... *99* = *99* %	n = 0 ... *99*
	`Rn` [1]	Acceleration in %-steps of the configured maximum acceleration saved in register Rn; 0 = 100 %, 1 = 1 % ... *99* = *99* %	n = 0 ... *99*
	`@n` [1]	Absolute value of the acceleration in [m/s^2] or [10^3 °/s^2] saved in position register @n; permitted: 0.01 ≤ @n ≤ defined maximum acceleration	n = 0 ... *99*
Effect	With the following commands positioning is carried out at maximum with the acceleration specified here: – G01 and G02		
Example	`N000 G09 X50` ;Braking ramp = 50 % `N001 G01 X100 FX50` ;Move to position X100 `N002 G01 X150 FX50` ;Move to position X150 `N003 G09 X0` ;Approach ramp with maximum acceleration		
Remark	This command has a saving effect. It remains effective until a new braking ramp is defined.		

[1] This syntax is only available as from operating system version 4.6. Programs which contain this syntax cannot be edited with control panel type SPC200-MMI-1... .

G25	**Position-dependent switch to next record** – permitted in operating modes: Start/Stop		
`Nn G25 X<Preselect> [Y.., Z.., U..]`			
`<Prese-lect>`	`n`	Preselect value in % of the path to be traversed; 0 = 0 % (switch further immediately), 1 = 1 % ... 99 = 99 %	n = 0 ... 99
	`Rn` [1]	Preselect value in % of the path to be traversed saved in register Rn permitted: 0 ... 100; 0 = 0 %; 100 = 100 %	n = 0 ... 99
	`@n` [1]	Absolute position specification of the preselect value in [mm] or [°] saved in the position register @n; permitted: current nominal position ≤ @n ≤ new nominal position or current nominal position ≥ @n ≥ new nominal position	n = 0 ... 99
Effect	If an axis is positioned, for which a position-dependent switch to the next record has been programmed, a switch will be made to the next NC record when the position defined in the preselect is reached. The SPC200 is then in the position to process further NC records, while the axis traverses the remaining path to the target position. The G25 command remains active until: – the preselect value is reached with a positioning command G00, G01, G02 or M10 with mode 2 ... 4 – the G25 command is deactivated with command M12 – a fault occurs in executing G25. As subsequent commands after further switching to the next record, all NC commands are permitted, with the exception of the following NC commands for the same axis: M39 and G00. If after switching to next record (set mass evaluation) a M37 command occurs that concerns the moving axis, this becomes active only for the next traversing task. Positioning commands must not however demand a change of direction of the running positioning procedure. With **stepping motor axes:** If the G25 command refers to a stepping motor axis, the subsequent commands must not refer to the same stepping motor axis, except for: the M12 command. With **multi-axis systems:** You can program preselect values for several axes in one NC record. The preselect values of the individual axes remain valid until a positioning command is executed for the relevant axis and the preselect value is therefore reached. The further switching conditions of several axes can be linked by a positioning command (see example 4).		
[1] This syntax is only available as from operating system version 4.6. Programs which contain this syntax cannot be edited with control panel type SPC200-MMI-1... .			

G25	**Position-dependent switch to next record** – permitted in operating modes: Start/Stop
Example	See below (examples 1...6)
Remark	This command enables: – the speed and acceleration in the current positioning procedure to be switched in the case of **pneumatic drives** – obstructions to be bypassed time-optimized in the case of multi-axis systems. If a stop is triggered when the preselect value is exceeded and a switch is made to the next record, the target position will be retained. If a stop is triggered before the preselect value is reached, the position of the preselect value will also be retained. In the case of M10 with mode 0 or 1, G25 has no effect. In this case switching to the next record remains active until the next positioning command.

Speed/acceleration switching (only with pneumatic drives)

Transition to a new nominal speed takes place with the currently set values for approach acceleration or braking. Automatic limiting to realistic acceleration values is not undertaken.

Caution
Unrealistically high nominal acceleration values can lead to heavy overswing and therefore to damage to the axis. When using command G25, make sure that realistic nominal acceleration values are set with regard to the axis used as well as to the remaining path to be traversed.

If the remaining positioning path is not sufficient for coming to a stand within the set delay, a stop will be triggered automatically (fault no. nnn03x06). In this case shift the switching condition forward or set a steeper braking ramp.

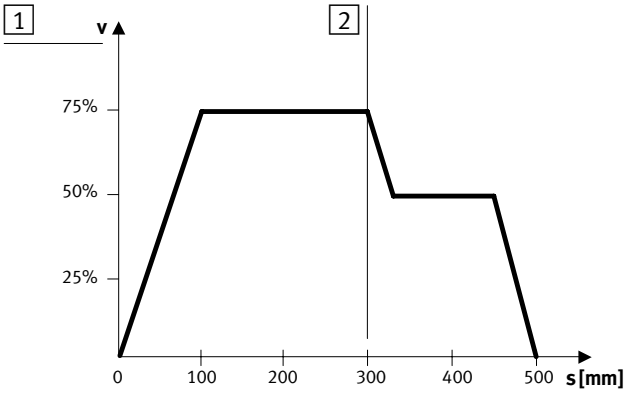
With G02 positioning commands, an automatic stop can also be triggered if the condition for further switching lies in the range of the delay phase. In this case, use positioning command G01.

Example 1

Modify speed; only permitted with pneumatic drives

```
N010 G00 X0
N011 G25 X60
N012 G01 X500 FX75
N013 G01 X500 FX50
```

After 60 % of the positioning path from position 0 to position 500, the SPC200 reduces the speed from 75 % to 50 % of the configured maximum speed.



1 Speed in % of the configured maximum speed

2 Preselect value of the X-axis

Fig. 5/9: Example: Modify speed
(only permitted with pneumatic drives)

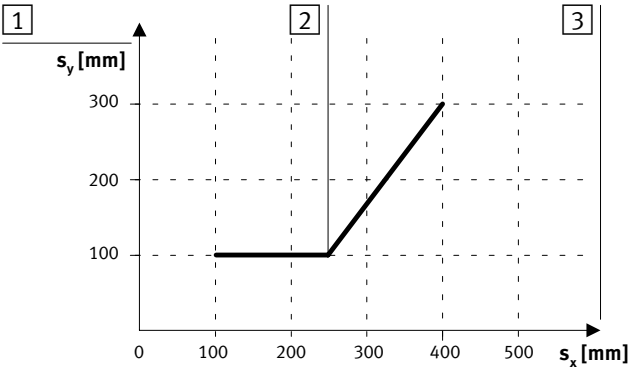
Switching to the highest possible speed (NC command G00) in current operation is not supported.

Example 2

Time-optimized bypassing

```
N010 G00 X100 Y100
N011 G25 X50
N012 G00 X400
N013 G00 Y300
```

The SPC200 processes the next NC record after 50 % of the positioning path from position X100 to position X400.



1 Positioning path of the Y-axis in mm

2 Preselect value of the X-axis

3 Positioning path of the X-axis in mm

Fig. 5/10: Example: Time-optimized bypassing (example linear drive)

The Y-axis therefore begins to move to position Y300, although the X-axis has not yet completed the positioning procedure.

Example 3

Event-dependent further switching to next record

```
N010 G00 X0
N011 G25 X1
N012 G01 X500 FX60
N013 #TNI0.0 13
N014 G01 X500 FX10
```

When 1 % of the positioning path from X0 to X500 has been traversed, the SPC200 switches further to NC record N013. The program waits in this record until the event occurs (here 1-signal at input I0.0). Only then, where applicable, switching is made to the next positioning task (here speed reduction) during the processing procedure.

If the event occurs after the target position has ben reached, the following command in this example will have no effect, as the same target position (X500) has been programmed.

Tip:
If you use the G25 command together with the axis status flags (see chapter 5.3.6), it can be sensible to insert a waiting time of at least 10 ms after the positioning command. This applies particularly with the status flags MC and MOV.
Note that with a pneumatic axis, there is always a delay before it responds to the start signal.

Example 4

Further switching to generate its own MC signal

```
N010 G25 X0      ;immediate further switching
N011 G00 X200    ;Move to position 200
N012 #RQ0.1      ;Delete output Q0.1: MC_X=0
N013 G04 3       ;Wait 30 ms
N014 #TNF72 14   ;Positioning task not yet
                 ;completed?
N020 #SQ0.1      ;Set Q0.1, MC_X=1
```

Example 5 Linked further switching condition

```
N010 G01 X0 FX0 Y0 FY0 Z0 FZ0
N011 G25 X10 Y10 Z10
N012 G01 X100 FX10
N013 #SQ0.0
N014 G01 Y100 FY10 Z100 FZ10
N015 .......
```

The SPC200 saves the preselect values for the axes X, Y and Z in NC record N011. In the next NC record only the X-axis is moved. When the X-axis reaches the preselect value, output Q0.0 will be set.

The axes Y and Z are moved in NC record N014. Switching is made to the next NC record if both axes have reached the preselect value programmed under N011 (AND-linking).

If, beside the axis for which a preselect value has been programmed, other axes are also to be positioned with the same NC record, a preselect value of 100 % will apply to these axes.

```
N015 G01 X0 FX0 Y0 FY0
N016 G25 X50
N017 G01 X200 FX0 Y200 FY0
N018 #SQ0.0
N019 ...
```

Output Q0.0 will be set if the Y-axis has reached position Y200 and the X-axis has reached the programmed preselect value (here X100).

Example 6 Linked further switching condition with correctly used command M37

```
N010 M37 X50        ;50% of the workpiece mass
N011 G25 X20        ;switch to next record after 20% of
                    ;traversing distance
N012 G01 X400 FX20 ;position 400 with 20% of the config. speed
                    ;and 50% of workpiece mass
N013 #SQ0.0         ;Set ouput Q0.0
N014 M37 X0         ;100% of the workpiece mass
N015 G01 X400 Fx50 ;Finish traversing task from N012 with
                    ;50% of the config. speed Speed:
                    ;and 50% of the workpiece mass.
                    ;The new mass from N014 is not
                    ;yet effective here!
N016 ...
N017 G00 X10        ;Position 10 with 100% workpiece mass
N...
```

G28	**Load position value into the position register** – permitted in operating modes: Start/Stop		
`Nn G28 <Target> X<Source> [Y.., Z.., U..]`			
`<Target>`	`@n`	Number of the target position register @n	n = 0 ... *99*
`<Source>`	`n`	Position value, speed value or acceleration value	n = ±*9999.99*
	`@n`	Position value, speed value or acceleration value saved in source position register @n	n = 0 ... *99*
Effect	Loads the position value or register value into the target position register.		
Example	`N010 G28 @0 X10 Y10` ;Loads the value 10 into the position register 0 ;of the X and Y-axis `N011 G28 @1 X@99` ;Loads the value from position register 99 of the ;X-axis into position register 1 of the X-axis		
Remark	Position registers are saved and protected against power failure (remanent). Each configured axis has its own position register record. The positions contained in the position list are saved here.		

G29	**Add position value and position register** – permitted in operating modes: Start/Stop		
`Nn G29 <Target> X<Source> [Y.., Z.., U..]`			
`<Target>`	`@n`	Number of the target position register @n	n = 0 ... 99
`<Source>`	`n`	Position value, speed value or acceleration value	n = ±9999.99
	`@n`	Position value, speed value or acceleration value saved in source position register @n	n = 0 ... 99
Effect	Forms the sum of position and register values or of two register values and saves the result in the target register.		
Example	`;(Register @X10=20)` `N010 G29 @10 X+10.5` ;Add position value and ;position register value of the X-axis The position value 10.5 and the value from position register 10 of the X-axis (here 20) are added. The result (30.5) is saved in position register 10 of the X-axis.		
Remark	Position registers are saved and protected against power failure (remanent). Each configured axis has its own position register record. The positions contained in the position list are saved here.		

G60	**Exact stop without damping time** – pneumatic axis; – permitted in operating mode: Start/Stop, Record Select
`Nn G60 X [Y, Z, U]`	
Effect	Switches the specified axis to exact stop without damping time (positioning quality class 3, see also under G61). Output MC_A/MC_B or RC_A/RC_B always supplies a 1-signal when the specified axis is within the range of the positioning tolerance for the complete duration of the monitoring time (see also Fig. 5/13). If the axis leaves the tolerance range before the monitoring time expires, the monitoring time will be reset.
Example	`N000 G60 X` ;Activate exact stop without damping time `N001 G00 X100` ;Move to position X100 (example: Positioning tolerance = 0.2 mm): When moving to position 100 mm, output MC_A/MC_B or RC_A/RC_B always supplies a 1-signal when the X-axis is within the range of the positioning tolerance (between 99.8...100.2 mm).
Remark	This command has a saving effect. It remains effective until a switch is made to Fast Stop with command G62 or to any other positioning quality class with command G61. With nominal value modes 0 and 1, the set positioning quality class has no effect (see NC command M13).

Monitoring time

With the rotary module and with linear drives with a length of ‹ 300 mm the monitoring time is 20 ms. For linear drives with a length of › 300 mm the monitoring time can be calculated as follows:

Formula for linear drives over 300 mm in length
$T_{monitoring} = \left(L_{drive} + 100\right) \div 20$
$T_{monitoring}$ = monitoring time in [ms] L_{drive} = stroke length of linear drive in [mm]

Example linear drive (stroke length 500 mm):
Monitoring time in [ms] = (500 + 100) / 20 = 30

G61	**Set positioning quality class** – pneumatic axis; – permitted in operating mode: Start/Stop, Record Select		
`Nn G61 X<Quality class> [Y.., Z.., U..]`			
`<Quality class >`	`n`	Positioning quality class	n = 0 ... 6
Effect	Switches the specified axis to the set positioning quality class. Output MC_A/MC_B or RC_A/RC_B always supplies a 1-signal when the axis fulfils the criteria of the set positioning quality class (see following table).		
Example	`N005 G61 X1` ;Positioning quality class = 1, Fast stop `N006 G00 X100` ;Move to position 100 mm `N007 G60 X` ;Exact stop without damping time When moving to position X100, output MC_A/MC_B or RC_A/RC_B always supplies a 1-signal when the X-axis enters the range of the positioning tolerance (fast stop without damping time). A switch is then made to exact stop without damping time.		
Remark	Command G61 has a saving effect. The positioning quality class remains effective until a switch is made to another positioning quality class. The individual positioning quality classes are described in the following table. With nominal value modes 0 and 1, the set positioning quality class has no effect (see NC command M13).		

Type	Positioning quality class	Description
Presetting	0	Switches to the positioning quality class (1...6) set in the application data.
Fast stop [1]	1	Fast stop without damping time Output MC_A/MC_B or RC_A/RC_B always supplies a 1-signal when the axis first enters the range of the positioning tolerance (see Fig. 5/11).
	2	Fast stop with damping time As 1, but there is still a damping time [2] after the axis enters the range of the positioning tolerance, before the relevant output supplies a 1-signal (see Fig. 5/12).
Exact stop	3	Exact stop without damping time Output MC_A/MC_B or RC_A/RC_B always supplies a 1-signal when the specified axis is in the positioning tolerance for the complete duration of the monitoring time [3] (see also Fig. 5/13). If the axis leaves the tolerance range before the monitoring time expires, the monitoring time will be reset.
	4	Exact stop with damping time As 3, but there is still a damping time [2] after the monitoring time [3] expires, before the relevant output supplies a 1-signal (see also Fig. 5/14).
	5	Exact stop with end speed control As 3, but for the duration of the monitoring time [3] the drive must also stand almost still in the range of the positioning tolerance (end speed control) [4].
	6	Exact stop with damping time and end speed control As 5, but after the monitoring time [3] expires, there is still a damping time [2] before the relevant output supplies a 1-signal.

1) In positioning quality classes 1 and 2 the adaption has no effect, see system manual for the SPC200.
2) The damping time lasts 200 ms. If the tolerance range is left before the damping time expires, the damping time will **not** be reset.
3) The length of the monitoring time can be calculated (see under G60). If the tolerance range is left before the monitoring time expires, the monitoring time will be reset.
4) During the end speed control the speed tolerance is 8.0 mm/s (linear drive) or 8.0°/s (rotary module).

1 Nominal position value

2 Range of the positioning tolerance

3 Reaching the tolerance range

4 MC_A/MC_B or RC_A/RC_B

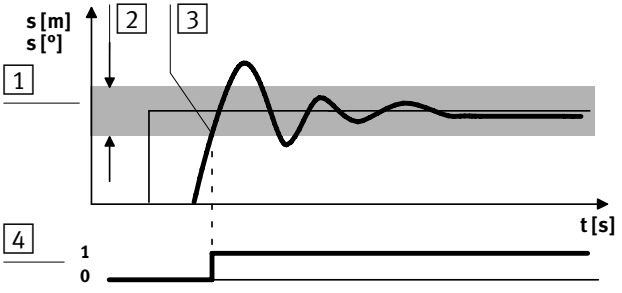


Fig. 5/11: Fast stop without damping time

1 Nominal position value

2 Range of the positioning tolerance

3 Reaching the tolerance range

4 Damping time period (200 ms)

5 MC_A/MC_B or RC_A/RC_B

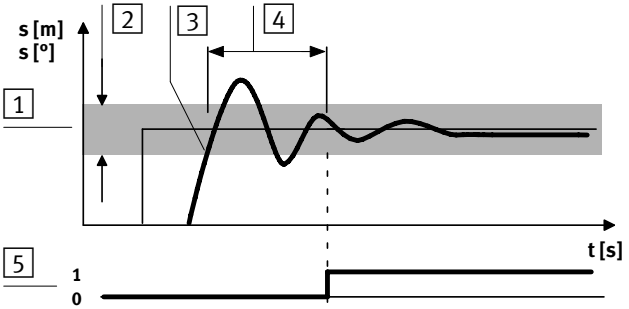


Fig. 5/12: Fast stop with damping time

1 Nominal position value

2 Range of the positioning tolerance

3 Monitoring period depending on drive

4 Expiry of monitoring time

5 Monitoring time

6 MC_A/MC_B or RC_A/RC_B

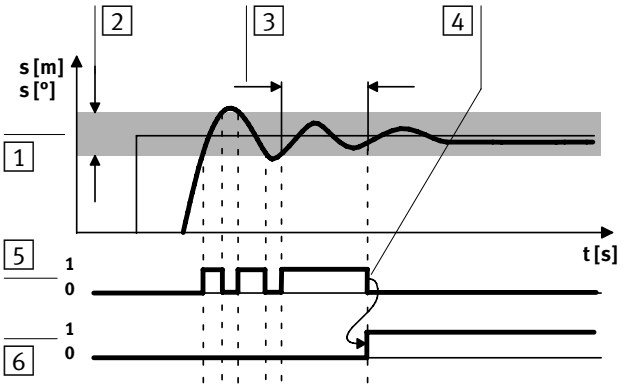


Fig. 5/13: Exact stop without damping time

1 Monitoring period depending on drive

2 Expiry of monitoring time

3 Expiry of damping time

4 Monitoring time

5 Damping time

6 MC_A/MC_B or RC_A/RC_B

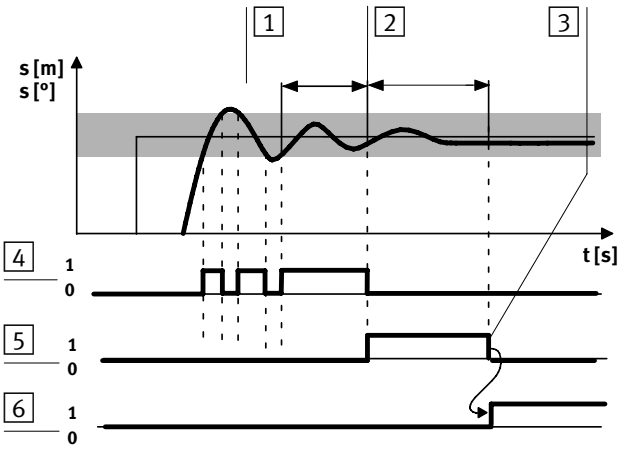


Fig. 5/14: Exact stop with damping time

G62	**Fast stop without damping time** – pneumatic axis; – permitted in operating mode: Start/Stop, Record Select
`Nn G60 X [Y, Z, U]`	
Effect	Switches the specified axis to fast stop (positioning quality class 1). Output MC_A/MC_B or RC_A/RC_B always supplies a 1-signal when the axis first enters the range of the positioning tolerance (see Fig. 5/11).
Example	`N000 G60 X` ;Activate exact stop without damping time `N001 G00 X200` ;Move to position X200 mm `N002 G62 X` ;Activate exact stop without damping time `N003 G00 X100` ;Move to position X100 `N004 G00 X300` ;Move to position X300 mm When moving to position X100, output MC_A/MC_B or RC_A/RC_B always supplies a 1-signal when the X-axis enters the range of the positioning tolerance. The SPC200 is ready immediately to move to position X300.
Remark	This command has a saving effect. The fast stop remains valid until a switch is made to another positioning quality class. In positioning quality class 1 the adaption has no effect, see system manual for the SPC200.

G74	**Start reference travel** [1)] – pneumatic axis; – permitted in operating mode: Start/Stop, Record Select		
`Nn G74 X<Mode> [Y.., Z.., U..]`			
`<Mode>`	`n`	Reference travel mode	n = 0, 5, 6, 7
Effect	Starts reference travel of the axis in the mode specified (see Fig. 5/15). After successful reference travel the status flag REF is set.		
Example	`N000 G74 X5` ;Move to reference point, direction: ;“retracted piston rod”		
Remark	– Defining the reference point and the reference position see system manual for the SPC200. – The reference mode is defined in the application data when each pneumatic axis is configured. If a different mode is selected with command G74, fault zzz1Ax06 will be generated (zzz = program line, x = axis number) at the beginning of the execution of the command. Exception: Reference travel mode 7 can always be used irrespective of the definition in the application data. – If the modes 1, 2, 3 and 4 are activated for a pneumatic axis, fault zzz1Ax06 will be generated (zzz = program line, x = axis number). – A pneumatic axis cannot execute positioning commands without successful reference travel. Exception: NC command M39 or reference travel with mode 7.		

[1)] This function is only effective as from operating system version 4.82. It is not supported by the control panel.

In the case of a pneumatic axis with an incremental measuring system, referencing is always carried out against a fixed stop. Depending on its position, it will be approached from the left or the right. This stop can be fitted externally or it can be the end stop of the cylinder itself.
The reproducibility of the reference point depends exclusively on the accuracy of the stop.

For commissioning, the offset of the reference position and reference travel mode must be defined in the application data. The offset reference position specifies the offset of the axis zero point from the reference point. It is always a positive variable. This offset value also influences the controller optimization of the SPC200, even small values (a few mm) must be specified as accurately as possible (see system manual for the SPC200).

Mode	Description

0	The reference point is set at the current position.
	– The status flag REF will be set immediately.
	– There are no restrictions as regards the speed and acceleration limit values (compare with mode 7).
	This mode may only be used if you can be sure that the axis actually stands at the planned reference position.
	For example, you can move program-controlled to the defined end stop with NC command M39, monitor the reaching of the position with the aid of a proximity switch and finally accept the reference point with mode 0.
	Example
	`N000 #TF64 7 ;REF flag of the X-axis set?`
	`N001 M40 X0 ;Cancel all limit value monitorings re. M39`
	`;(stroke and speed limit`
	`;values)`
	`N002 M39 X45 ;Switch off controller and open valve`
	`;statically in the direction smaller`
	`;position values.`
	`N003 #TNI0.0 3 ;Test input I0.0 (reference switch)`
	`;for 0, until stop is reached`
	`;(I0.0 = 1)`
	`N004 G04 50 ;Wait 500 ms`
	`N005 M12 X ;Activate controller again`
	`N006 G74 X0 ;Set reference point`
	`N007 ...`

5	Reference travel in negative direction (retract piston rod up to rear stop or cylinder cover). – As soon as the axis stands still, the reference point is set. – The status flag REF will be set immediately.
6	Reference travel in positive direction (extend piston rod up to front stop or bearing cover). – As soon as the axis stands still, the reference point is set. – The status flag REF will be set immediately.

Mode	Description
7	This mode serves exclusively for moving the pneumatic axis slowly and program-controlled, providing referencing has not taken place. – When mode 7 is activated with command G74, the axis can be moved with the positioning commands G01 or G02. – The speed is limited in each case to the referencing speed (see application data). – The acceleration values are **clearly** reduced. – The status flag REF will **not** be set. – After completion of the movement in mode 7, reference travel must take place with mode 0, 5 or 6 in accordance with the application data. Only then can the maximum dynamics of the axis be reached again. This mode can be used, e.g. for moving an axis manually but program-controlled into a defined starting position, if this cannot take place automatically due to obstructions in the positioning path.

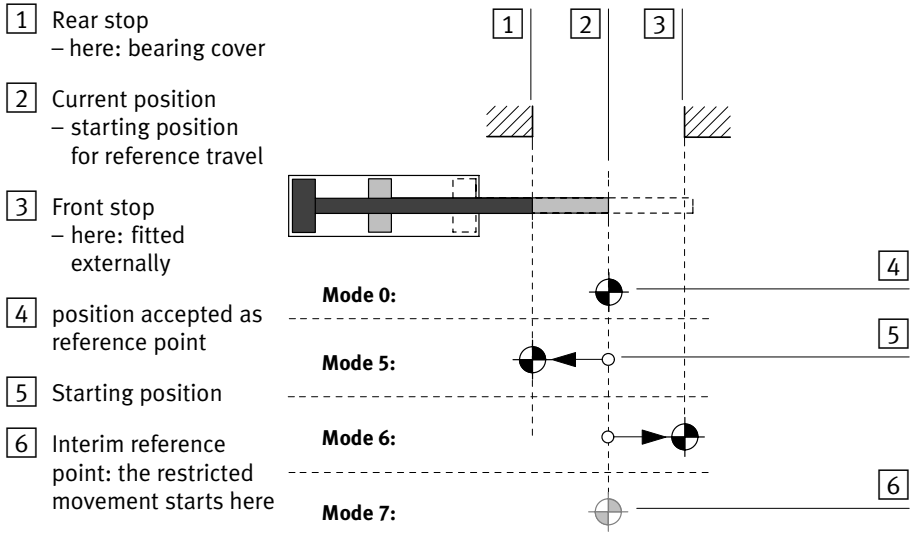


Fig. 5/15: Reference travel modes for the pneumatic axis

G74	**Starting reference travel** – stepping motor axis; – permitted in operating modes: Start/Stop, Record Select		
`Nn G74 X<Mode> [Y.., Z.., U..]`			
`<Mode>`	`n`	Reference travel mode	n = 0...4
Effect	Starts reference travel of the axis in the mode specified (see Fig. 5/16).		
Example	`N000 G74 X0` ;Accept current position as ;reference point		
Remark	All positions refer indirectly to reference point. The exact position of the switching point of the reference switch depends on the selected reference travel mode.		

Mode	Description
0	Accepting the current axis position as reference point
1	Reference travel in negative direction to reference switch (REF) with acceptance as reference point
2	Reference travel in negative direction to negative limit switch (LIM-) with acceptance as reference point
3	Reference travel in positive direction to reference switch (REF) with acceptance as reference point
4	Reference travel in positive direction to positive limit switch (LIM+) with acceptance as reference point

1 Starting position

2 Position accepted as reference point

3 Switching ranges of limit and reference switches

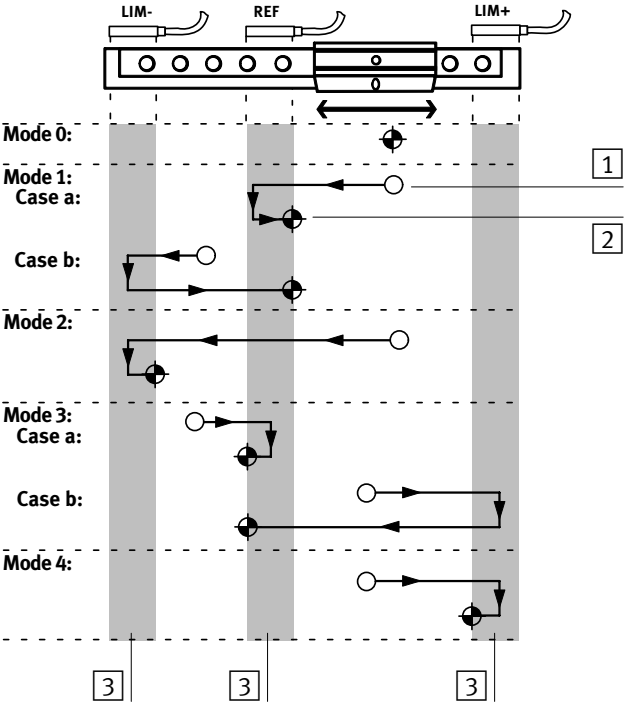


Fig. 5/16: Reference travel modes of the electric axis

Detailed instructions on carrying out reference travel can be found in the manual for the stepping motor indexer module type P.BE-SPC200-SMX-... .

If the SPC200 enable is removed (ENABLE = 0), the stepping motor axes lose the reference.

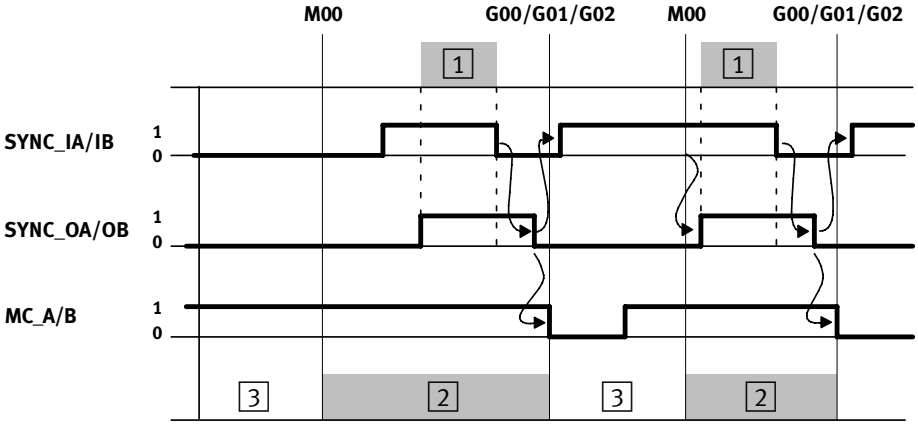
G90	**Absolute dimension specification** – permitted in operating modes: Start/Stop, Record Select		
`Nn G90 X<Position> [Y.., Z.., U..]`			
`<Position>`	`n`	Position in [mm] or [°]	n = ±9999.99
	`@n`	Position in [mm] or [°] saved in the position register @n	n = 0 ... 99
Effect	Switches to absolute positioning and moves absolutely at the current speed and, if applicable, with ramp to the specified position. All the subsequent positions in the program will be interpreted as absolute dimensions. The positioning mode remains valid until a new positioning mode is set (see also under G00/G01/G02).		
Example	`N000 G00 G90 X200` ;Move absolutely at highest possible ;speed to position X200 `N001 X100` ;Move absolutely at highest possible ;speed to position X100 `N002 X@5 Y@1` ;Move to position from register 5 and register 1 `N003 G90 Y100` ;Move absolutely to position Y100 `N004 G91 X100` ;Move 100 mm in a positive direction		

Remark	The following is set during positioning:
	– absolute positioning (G90)
	Command G90 has a saving effect. It remains effective until it is cancelled by command G91.
	Example:
	`N010 G90 X100`
	`N011 X200`
	`N012 G91 X300`
	With WinPISA programming, positions can also be specified symbolically. For this purpose, the position values and position names are entered in the position list.
	Example:
	`N010 G90 X@ABHOL_POS`
	`N011 X@ABLAGE_POS`		

G91	**Relative dimension specification** – permitted in operating modes: Start/Stop, Record Select		
`Nn G91 X<Position> [Y.., Z.., U..]`			
`<Position>`	`n`	Position in [mm] or [°]	n = ±*9999.99*
	`@n`	Position in [mm] or [°] saved in the position register @n	n = 0 ... *99*
Effect	Switches to relative positioning and moves relatively at the current speed and, if applicable, with ramp to the specified position. All the subsequent positions in the program will be interpreted as relative dimensions. The positioning mode remains valid until a new positioning mode is set (see also under G00/G01/G02).		
Example	`N000 G00 G91 X200` ;Move relatively at highest possible ;speed 200 mm further `N001 X100` ;Move relatively at highest possible ;speed 100 mm further `N002 G90 X@5 Y@1` ;Move to position from register 5 and register 1 `N003 G91 X-100` ;Move 100 mm in a negative direction `N004 X200` ;Move 200mm in a positive direction		

Remark	The following is set during positioning:
	– absolute positioning (G90)
	Command G91 has a saving effect. It remains effective until it is cancelled by command G90.
	Example:
	`N010 G91 X100`
	`N011 X200`
	`N012 G90 X300`
	With WinPISA programming, positions can also be specified symbolically. For this purpose, the position values and position names are entered in the position list.
	Example:
	`N013 G91 X@ABHOL_POS`
	`N014 X@ABLAGE_POS`		

M00	**Programmed stop** – permitted in operating modes: Start/Stop
`Nn M00`	
Effect	The program sequence will be stopped with command M00 and continued when a synchronization signal is received. In the operating mode Start/Stop a negative edge at input SYNC_IA/IB will be interpreted as a synchronization signal.
Example	`N005 M00` ;Wait for SYNC signal `N006 G00 X100` ;Move to position X100
Remark	In Start/Stop mode you can synchronize with this command the program sequence with other devices.



1 Externally controlled process

2 Programmed stop

3 Program sequence

Fig. 5/17: Programmed stop

M02	**Sub-program end** – permitted in operating modes: Start/Stop
`Nn M02`	
Effect	The end of sub-programs must be marked with this command. If the program is accessed as the main program, it will be executed once and will remain stopped with M02. It can only be restarted with a Program Reset.
Example	See under L
Remark	See also under M30

M10	**Activate the nominal value input** – permitted in operating modes: Start/Stop

`Nn M10 X<Factor> [Y.., Z.., U..]`

`<Factor>`	`n`	Scaling factor in [mm/V] or [°/V] (see Fig. 5/18)	n = 0.1 ... *9999.9*
		No specification of a scaling factor [1]	–
	`@n`	Scaling factor saved in position register @n [2]	n = 0 ... *99*

Effect	The effect of command M10 depends on the syntax. – Without specification of a scaling factor (e.g. “M10 X”): All settings undertaken with M10, M11, M13 or M14 will be reset to the configured standard values (parameter set for the axis, register card “Nominal value specification”). The input for the direct nominal value specification will be activated with the configured standard values. – With specification of a scaling factor (e.g. “M10 X200.5”): The input for analogue nominal value specification is activated with the specified scaling factor. Settings for offset, mode or analogue channel assignment defined with the commands M11, M13 and M14 are valid. Otherwise the configured standard settings are used. With the scaling factor, you can specify the positioning path which is to be covered by the analogue nominal value specification (0 ... 10 V) (e.g. factor = 20, possible positioning path = 200 mm). The scaling factor has no effect with the digital setpoint value specification (input 5). In this case, the setpoint values are absolute position values that refer to the project zero point. PROFIBUS: The setpoint values are specified by the PLC in µm. (Example: Target position 88.24 mm -> output data of the PLC = 882400 – presented as decimal) DeviceNET: The setpoint values are specified by the PLC in µm.
Example	See following pages
Remark	– The reference point of the positioning range is the project zero point. – By specifying the offset (command “M11”) you can shift the reference point (see Fig. 5/18). – With modes 0 and 1 (see command M13), the analogue input must be deactivated with M12 before it can be activated again with M10. The command G25 has no effect in these modes. **With stepping motor axes:** modes 0 and 1 are not supported.

[1] This syntax is only available as from operating system version 4. The value 0000.00 is represented or entered on the control panel.
[2] This syntax is only available as from operating system version 4.82. It is not supported by the control panel.

The selected nominal value input is deactivated again with command M12. It is deactivated automatically:

– during a stop status (controlled stop)

– if enable is missing (0-signal at ENABLE input).

If there is a 1-signal again at the relevant input after a stop or missing enable, the nominal value input will be activated again automatically.

Example mode 0

Constant position adjustment

```
....
N010 M11 X100     ;Offset 100 mm
N011 M13 X0       ;Set mode 0
                  ;Move constantly
N012 M10 X30      ;Activate nominal value input
                  ;Scaling factor = 30 mm/V
N013 #TNI0.0 013 ;Wait until I0.0 supplies a
                  ;1-signal
N014 M12 X        ;Deactivate nominal value
                  ;input
...
N020 M30          ;Program end with
                  ;repeat
```

In this example the analogue input remains active until input I0.0 supplies a 1-signal. If the input supplies a 1-signal, the program will be continued in line N014 and the analogue input therefore deactivated.

Example mode 3

Analogue nominal value specification without adjustment, ramp

```
N001 M11 X100          ;Offset 100 mm
N002 M13 X3            ;Set mode 3
                       ;Move once
N003 G01 G91 X0 FX30 ;Move relative 0 mm
                       ;Speed ramp = 30%
N004 G61 X1            ;Fast stop
N005 M10 X30           ;Factor = 30, move
                       ;once to analogue
                       ;specified position
N006 G00 G90 X300      ;Move absolute
                       ;to position 300
...
...
N020 M30               ;Program end with repeat
```

The speed ramp can be set with the aid of commands G01 and G02. Programming is made here for movement to be made relatively by 0 mm (see line N003).

The speed ramp specified in this record is therefore valid without a positioning procedure.

M11	**Offset for analogue nominal value specification** – permitted in operating modes: Start/Stop		
`Nn M11 X<Offset> [Y.., Z.., U..]`			
`<Offset>`	`n`	Offset in [mm] or [°]	n = ±9999.98
	`@n`	Offset saved in position register @n [1]	n = 0 ... 99
Effect	Equalizes the voltage/position assignment (see Fig. 5/18).		
Example	Example see under M10		
Remark	– The preset reference point for the analogue nominal value specification is the project zero point. – By specifying the offset you can shift the reference point. – The possible positioning range is limited by the set software end positions. – The command M11 must be issued before M10. – The offset has no effect with the digital nominal value specification (input 5). [1]		
[1] This syntax is only available as from operating system version 4.82. It is not supported by the control panel.			

1 Project zero point

2 Measuring system length

3 Scal. factor = 30, Offset = 100

4 Scal. factor = 30, Offset = 0

5 Scal. factor = 10, Offset = 0

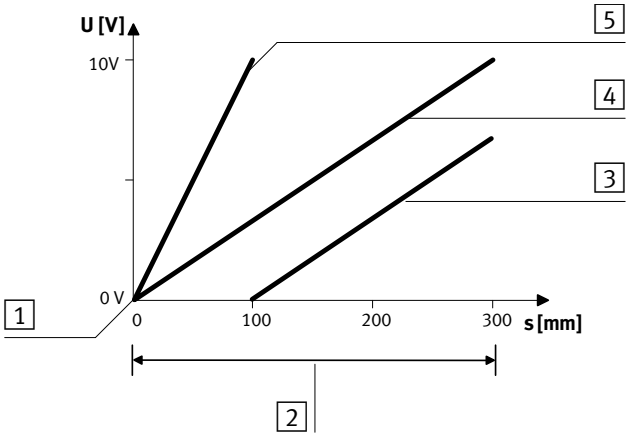


Fig. 5/18: Scaling factor and offset with bei analogue nominal value specification (example linear drive)

M12	**Axis stop** [1] – permitted in operating modes: Start/Stop
`Nn M12 X [Y, Z, U]`	
Effect	Command M12 stops all addressed axes. Active positioning commands (G00, G01, G02, M10) or the output of valve positioning values (M39) of these axes will be discontinued. Any nominal positions will be lost. – With pneumatic drives: The current actual positions will be accepted as new positions. Depending on the current speed of the drive there may be overswing. – With stepping motor axes: The axes stop as soon as possible (braking ramp with the configured maximum acceleration). The actual positions at the end of the stop will be accepted as new positions. Command M12 also causes the following: – With active nominal value specification via analogue input or field bus (digital nominal value specifcation [2]): The relevant nominal value inputs – analogue or digital – will be deactivated. – With active output of the valve positioning value (M39): [1] The output of the valve positioning value will be deactivated, the actual position will become the nominal position and the controller will be activated. – A preselect value defined with G25 will be deleted and further record switching (G25) will have no effect. [1] When the axes stop, the relevant output MC_A or MC_B (motion complete) will be set and the next NC record processed.
Example	Example see under M10
Remark	With modes 0 and 1 (see command M13) of the nominal value specification, the relevant nominal value input must be deactivated with M12 before it can be activated again with M10. Note that the constant repetition of the axis stop command (M12) (eg. in a program loop) can cause the drive to drift (see following instructions). In monitoring programs command M12 can also be used for stopping axes which hsve been reserved by another task (see also chapter 5.2.1).

[1] This function is only effective as from operating system version 4.6.
[2] This syntax is only available as from operating system version 4.82. It is not supported by the control panel.

During an axis stop with the M12 command the actual position will be accepted as the new nominal position.

Warning
If an interfering variable causes a deviation between the actual and nominal positions, the constant repetition of the axis stop command (M12) can cause the drive to drift. Each time the M12 command is accessed, the new actual position will be accepted again as the new nominal position.

Avoid the drifting by programming a locking which will prevent the constant repetition of the axis stop command (M12).

M13	**Set nominal value mode** – permitted in operating modes: Start/Stop		
`Nn M13 X<Mode> [Y.., Z.., U..]`			
`<Mode>`	`n`	Mode; explanation see table below.	n = 0...4
Effect	Switches to the specified mode (see following table).		
Example	Example see under M10		

Type	Mode	Description
Position adjustment	0 [1]	**This mode is only supported by pneumatic drives.** – Constant position adjustment – Constant parallel program processing possible
	1 [1]	**This mode is only supported by pneumatic drives.** – As mode 0 but without MC monitoring [2]
One-time positioning	2 [3]	– Current nominal value is read once – A move is made as fast as possible to the new position, identical to G00
	3 [3]	– Current nominal value is read once – Move with current ramp, identical to G01
	4 [3]	– Current nominal value is read once Only with pneumatic drives: – Smooth movement with current ramp, identical to G02 Only with stepping motor axes: – Move to position at Start/Stop frequency, identical to G02

[1] Fast stop as positioning quality class is always effective in this module (see Fig. 5/11). The set positioning quality class and the positioning timeout have no effect in this mode. Stepping motor axes are not supported in this mode. .

[2] Signal at output MC_A or MC_B is not influenced by the relevant axis, the current positioning quality class is effective (see under G61).

[3] In this mode all the last defined or valid movement parameters are used (approach and braking ramps, positioning quality class, etc.).

M14	**Assign nominal value inputs** – permitted in operating modes: Start/Stop

```
Nn M14 X<Input> [Y.., Z.., U..]
```

<Input>	n	Number of the analogue or digital [1] nominal value input	n = 1 ... 4 n = 1 ... 5 [1]

Effect	– Withanalogue nominal value specification: The analogue input module type SPC200-2AI-U possesses two nominal value inputs (differential inputs). – Nominal value module no. 1: Nominal value inputs 1 and 2 – Nominal value module no. 2: Nominal value inputs 3 and 4 With command M14 one or several axes can be assigned to each analogue input channel. – With digital nominal value specification, only in conjunction with field bus: [2] – Nominal value input 5 A separate digital nominal value is provided for each axis [X, Y, Z, U] at the same time via the field bus. This value corresponds to a position specification (see under M10) and is related to the project zero point. The nominal values must lie within the permitted limits of the relevant drive.
Example	`N007 M14 X2 Y5 U1` ;Anal. nominal value input 2 is assigned to the X-axis, ;digital nominal value input 5 is assigned to the Y-axis ;and analogue nominal value input 1 is assigned to the ;U-axis

[1] This syntax is only available as from operating system version 4.82. It is not supported by the control panel.

[2] For Profibus this applies only as from operating system version 4.82 together with the Profibus software version 2.0. For DeviceNet as from operating system 4.90 together with the software version as from 2.01 (DN2). Interbus does not permit this feature.

M30	**Program end with repetition** – permitted in operating modes: Start/Stop

```
Nn M30
```

Effect	The end of programs must be marked with this command. This command causes the program to be continued at the first NC record.
Example	`N007 G00 X100` ;Move to position X100 `N008 M30` ;Program end
Remark	Sub-program end see under M02

M37	**Set mass assessment** – pneumatic axis; – permitted in operating mode: Start/Stop		
`Nn M37 X<Mass> [Y.., Z.., U..]`			
`<Mass>`	`n`	Mass assessment of the load in % of the configured work item mass or of the configured mass moment of inertia of the work item; 0 = 100 %, 1 = 1 %.....99 = 99 %	n = 0 ... 99
	`@n`	Absolute value of the work item mass in [kg] or of the mass moment of inertia in [kgcm^2], saved in register @n [1)] Permitted value range: 0.0 ... max. work item mass	n = 0 ... 99
Effect	Sets the controller to the specified mass load (see system manual for the SPC200). – The following applies with relative assessment of the work item mass: Mass load = work item mass * n [%] + total moveable mass without work item – The following applies with absolute specification of the work item mass: Mass load = @n + total moveable mass without work item		
Example	`N001 M37 X50` ;50 % of the configured work item mass considered `N002 M37 X@88` ;work item mass from register @88 considered		
Remark	– The work item mass is a parameter of the application data. – This command has a saving effect and supports the procedure with different work item masses. – With rotary drives the mass moment of inertia of the work item and the other moving parts apply here. Recommendation: Carry out dynamic identification travel with minimum and maximum masses if you wish to use this NC command optimally.		
[1)] This syntax is only available as from operating system version 4.82. It is not supported by the control panel.			

Please note
If the work item mass in its basic status does not correspond to the max. work item mass, you must make sure that before a positioning command the mass load is adapted to the actual work item mass. Remember the saving effect of the command and that after every Power-On, Data, System or Program Reset the basic status is activated again.

M38	**Load actual value** – permitted in operating modes: Start/Stop		
`Nn M38 @<Register> X [Y, Z, U]`			
`<Register>`	`n`	Register number	n = 0 ... *99*
Effect	The current position is loaded into the specified position register		
Example	`N003 G00 G91 X100` ;Move relatively 100 mm further `N004 M38 @1 X` ;Load current position into position register 1 ;of the X-axis `N005 G29 @0 X@1` ;Form the sum of the two position registers 0 ;and 1, save result in position register 0 `N006 G00 G90 X@0` ;Move to position in register 0		

M39	**Output valve positioning value** [1] – pneumatic axis; – permitted in operating mode: Start/Stop		
`Nn M39 X<Positioning value> [Y.., Z.., U..]`			
`<Positioning value>`	`n` [1]	Valve positioning value in % of the range 0...10 V: 1 = 1 % ... *99* = *99* %	n = 1 ... *99*
	`Rn` [1]	Valve positioning value in % saved in register Rn	n = 1 ... *99*
Effect	With command M39, the controller of the SPC200 will be deactivated and the proportional directional control valve will be controlled directly. Whilst the drive is standing still, a pressing force, e.g. against a work item, may be generated. With the positioning value you can specify the valve nominal voltage (0.1 ... *9.9* V) which is to be output. At approx. 5 V (50 %) the valve slide is in the mid-position (see following table). The positioning value controls the flow of the valve and determines the pressure increase time up to the maximum pressure (supply pressure). Command M39 remains active until it is deactivated with command M12 or until the stroke limit value (M40), the software end positions or the speed limit value (M41) are exceeded.		
Example	`N018 G01 X400 FX0` ;Move quickly to pre-holding position `N019 G01 X420 FX5` ;Move slowly to clamping position `N020 #TI2.0 30` ;Jump output of valve positioning value `N021 M40 X2.00` ;Stroke limit value for M39 = 2 mm `N022 M41 X0.15` ;Speed limit value for M39 = 0.15 m/s `N023 M39 X60` ;Valve nominal value voltage = 4 V `N024 #TNI2.1 24` ;Wait for input signal `N025 M12 X` ;Switch off M39 `...` ; ... `N030 G01 X100 FX10` ;... Further program sequence		
Remark	Command M39 may only be accessed if no positioning command has been carried out. Otherwise an appropriate fault will be triggered. In order to avoid an uncontrolled movement, e.g. during incorrect programming, the SPC200 monitors the position and the speed of the drive. Presetting for monitoring: – Stroke limit value = ±10.00 [mm] or ±10.00 [°] – Speed value = 0.10 [m/s] or 0.1 [10^3 °/s] The presettings can be modified with commands M40 and M41. The monitoring of the software end positions remains active.		

[1] This syntax is only available as from operating system version 4.6. Programs which contain this syntax cannot be edited with control panel type SPC200-MMI-1... .

Valve positioning value [%]	Positioning signal [1]	Valve voltage [V]	Effect
–	– [2]	– [2]	↑ Proportional directional control valve pressurizes connection 4 → Effect of force in the direction of the measuring system zero point (smaller positioning values)
1	-0.98	9.9	
2	-0.96	9.8	
...	...	...	
49	-0.02	5.1	Mid-position range of the valve (covered), flow blocked
50	0.00	5.0	
51	0.02	4.9	
...	...	...	↓ Proportional directional control valve pressurizes connection 2 → Effect of force in the direction away from the measuring system zero point (larger positioning values)
98	0.96	0,2	
99	0.98	0.1	
–	–	–	

1) Standardized valve positioning signal
2) Specification not possible

The valve voltage can be calculated as follows:

Formula	
$V_{valve} = 10 * \left(1 - \frac{n}{100}\right)$	
V_{valve}	= valve voltage in [V]
n	= valve positioning value in [%]

M40	**Set stroke limit value** [1] – pneumatic axis; – permitted in operating mode: Start/Stop		
`Nn M40 X<Tolerance> [Y.., Z.., U..]`			
`<Limit value>`	`n` [1]	Stroke limit value in [mm] or [°]; 0 ≙ Stroke limit value isswitched off permitted: 0 ≤ Limit value ≤ stroke length or angle	n = 0 ... *9999.99*
	`@n` [1]	Stroke limit value in [mm] or [°] saved in the position register @n	n = 0 ... *99*
Effect	If the drive exceeds the defined stroke limit value when command M39 is accessed (in positive or negative direction), M39 will be deactivated, an appropriate fault will be shown and the axis will be stopped (controlled stop). If 0 is specified as the stroke limit value, the drive can move freely between the software end positions. In the case of drives with an incremental measuring system (e.g. B. DNCI-...) without reference travel carried out, the axis can move freely without limits. **Please note** When the stroke limit value (e.g. M40 X0) is switched off, the monitoring of the speed limit value (M41) will also be switched off.		
Example	See M39		
Remark	This command has a saving effect. It remains effective until a new stroke limit value is defined.		

[1] This syntax is only available as from operating system version 4.6. Programs which contain this syntax cannot be edited with control panel type SPC200-MMI-1... .

M41	**Set speed limit value** [1] – pneumatic axis; – permitted in operating mode: Start/Stop		
`Nn M41 X<Tolerance> [Y.., Z.., U..]`			
`<Limit value>`	`n` [1]	Speed limit value in [m/s] or [10^3 °/s]; permitted: 0,01 ≤ Limit value ≤ defined maximum speed	n = 0.01 ... *9.99*
	`@n` [1]	Speed limit value in [m/s] or [10^3 °/s] saved in position register @n	n = 0 ... *99*
Effect	If the speed of the drive exceeds the defined speed limit value when command M39 is accessed, M39 will be deactivated, an appropriate fault will be shown and the axis will be stopped (controlled stop). **Please note** When the stroke limit value (e.g. M40 X0) is switched off, the monitoring of the speed limit value (M41) will also be switched off.		
Example	See M39		
Remark	This command has a saving effect. It remains effective until a new speed limit value is defined.		

[1] This syntax is only available as from operating system version 4.6. Programs which contain this syntax cannot be edited with control panel type SPC200-MMI-1... .

L	**Access sub-program (load subroutine)** – permitted in operating modes: Start/Stop		
`Nn L<Program number>`			
`<Program number>`	`n`	Program number	n = 0 ... 99
	`Rn`	Program number saved in register Rn	n = 0 ... 99
Effect	Accesses the specified program as subroutine.		
Example	See below		
Remark	The program number can be specified directly (n) or indirectly via a register (Rn). Maximum nesting depth = 4.		

Example

Palletizing

1 Distance between rows

2 Positions

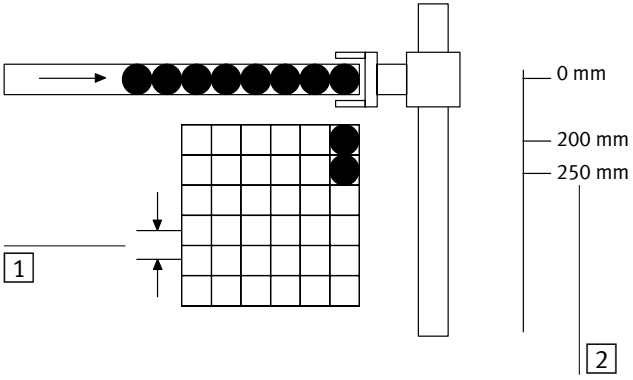


Fig. 5/19: Palletizing

Program 0

```
...
N003 G28 @1 X200 ;Load top row of pallets
N004 G28 @2 X50  ;Load distance between rows
N005 #LR0=6      ;Initialize number of rows
N006 L1          ;Access program 1
N007 #AR0=-1     ;Update counter
N008 #TR0=0 10   ;Gap filled?
N009 E05 6       ;Jump to N006
...              ;further commands
...
N080 M30         ;Program end
```

Subroutine 1: Fill pallet gap

```
N000 #TNI0.0 0   ;Wait for part
N001 G00 X0      ;Fetch part, position 0 mm
N002 #SQ0.0      ;Close gripper
N003 G00 X@1     ;Move to pallet position
N004 #RQ0.0      ;Open gripper, place part
N005 G29 @1 X@2  ;Calculate next position
...              ;further commands
...
N016 M02         ;Subroutine end
```

Position register @1 contains the current pallet position. Position register @2 contains the distance between the rows. These position registers are initialized in lines N003 and N004 (program 0).

Register R0 serves as loop counter and is initialized with the number of rows. Subroutine 1 is accessed 6 times and the current pallet gap is then filled.

E05	**Unconditional jump** – permitted in operating modes: Start/Stop		
`Nn E05 <Record number>`			
`<Record number>`	`n`	NC record number	n = 0 ... *999*
	`Rn`	NC record number saved in register Rn	n = 0 ... *99*
Effect	The program sequence is always continued at the specified jump target.		
Example	`N005 #TNI1.1 5` ;Wait for 1-signal at input I1.1 `N006 G00 X100` ;Move to position X100 `N007 E05 5` ;Jump to NC record 5 In NC record 7 the program always branches to NC record 5.		

#S	**Set single-bit operand** – permitted in operating modes: Start/Stop		
`Nn #S<Operand>`			
`<Operand>`	`Fn`	Flag with number Fn	n = 0 ... 63
	`Qn.n`	Outputs: all freely programmable outputs	n.n = 0.0 ... 13.15
Effect	The specified single-bit operand is set. Permitted operands are all single-bit operands, but not inputs. See also chapter 5.3.1.		
Example	`N010 #SQ0.0` ;Set output Q0.0		
	Output Q0.0 supplies a 1-signal when this record is processed.		
Remark	Certain outputs are reserved for pre-assigned functions. Flags are remanent.		

#R	**Reset single-bit operand** – permitted in operating modes: Start/Stop		
`Nn #R<Operand>`			
`<Operand>`	`Fn`	Flag with number Fn	n = 0 ... 63
	`Qn.n`	Outputs: all freely programmable outputs	n.n = 0.0 ... 13.15
Effect	The specified single-bit operand is reset. Permitted operands are all single-bit operands, but not inputs. See also chapter 5.3.1.		
Example	`N010 #RQ0.0` ;Reset output Q0.0 Output Q0.0 supplies a 0-signal when this record is processed.		
Remark	Certain outputs are reserved for pre-assigned functions. Flags are remanent.		

#T	**Test single-bit operand for 1-signal** – permitted in operating modes: Start/Stop		
`Nn #T<Operand> <Record number>`			
`<Operand>`	`Fn`	Flag with number Fn	n = 0 ... 63
	`Fn`	Axis status flag [1]	n = 64 ... 127
	`In.n`	Permitted inputs: all existing inputs	n.n = 0.0 ... 13.15
	`Qn.n`	Permitted outputs: all existing outputs	n.n = 0.0 ... 13.15
`<Record number>`	`n`	Record number	n = 0 ... 999
	`Rn`	Record number saved in register Rn	n = 0 ... 99
Effect	A branch is made to the specified NC record if the single-bit operand supplies a 1-signal. Otherwise the following NC record will be processed. Permitted operands are all single-bit operands. See also chapter 5.3.		
Example	See below		
Remark	See also under “Test register”		

[1] This syntax is only available as from operating system version 4.63. It is not supported by the control panel.

Axis status flag		**Flag number of the axis**			
Name	**Meaning**	**X**	**Y**	**Z**	**U**
REF	Reference set	64	65	66	67
MC	Motion Complete	72	73	74	75
TOL	Axis in the tolerance window	80	81	82	83
MOV	The axis moves	84	85	86	87

Example

The following applies for this example:
Operating mode: Start/Stop

In the following example binary-coded position numbers are sent to the axis controller via the inputs I0.0 and I0.1. Four position numbers can therefore be specified:

I0.1	I0.0	Positions
0	0	Po_1
0	1	Po_2
1	0	Po_3
1	1	Po_4

At the beginning of the program the programmed stop for synchronization with the higher-order PLC/IPC is used. With the SYNC signal, the outputs of the PLC/IPC for the binary-coded position number can be controlled at the same time. A debouncing time of 30 ms is provided for this in NC record 1.

```
N000 M00         ;Wait for SYNC signal
N001 G04 3       ;Debounce time 30 ms
N002 #TI0.1 8    ;Po_3 or Po_4, if 1-signal
N003 #TI0.0 6    ;Po_2, if 1-signal
N004 G00 X@Po_1 ;Po_1, if both inputs 0
N005 E05 0       ;Jump back
N006 G00 X@Po_2 ;Po_2, if 1-signal
                 ;only at I0.0
N007 E05 0       ;Jump back
N008 #TI0.0 11   ;Po_4, if both inputs 1
N009 G00 X@Po_3 ;Po_3, if 1-signal
                 ;only at I0.1
N010 E05 0       ;Jump back
N011 G00 X@Po_4 ;Po_4, if both inputs 1
N012 E05 0       ;Jump back
```

#TN	**Test single-bit operand for 0-signal** – permitted in operating modes: Start/Stop		
`Nn #TN<Operand> <Record number>`			
`<Operand>`	`Fn`	Flag with number Fn	n = 0 ... 63
	`Fn`	Axis status flag [1]	n = 64 ... 127
	`In.n`	Permitted inputs: all existing inputs	n.n = 0.0 ... 13.15
	`Qn.n`	Permitted outputs: all existing outputs	n.n = 0.0 ... 13.15
`<Record number>`	`n`	Record number	n = 0 ... 999
	`Rn`	Record number saved in register Rn	n = 0 ... 99
Effect	A branch is made to the specified NC record if the single-bit operand supplies a 0-signal. Otherwise the following NC record will be processed. Permitted operands are all single-bit operands. See also chapter 5.3.		
Example	`N030 #TNI0.0 30` ;Wait until I0.0 supplies a 0-signal		
Remark	See also under “Test register”		

[1] This syntax is only available as from operating system version 4.63. It is not supported by the control panel.

Axis status flag		**Flag number of the axis**			
Name	**Meaning**	**X**	**Y**	**Z**	**U**
REF	Reference set	64	65	66	67
MC	Motion Complete	72	73	74	75
TOL	Axis in the tolerance window	80	81	82	83
MOV	The axis moves	84	85	86	87

#LR	**Load register** – permitted in operating modes: Start/Stop		
`Nn #LR<Register> = <Value>`			
`<Register>`	`n`	Number of the register into which the value is loaded	n = 0 ... 99
`<Value>`	`n`	Value which is loaded into the specified register	n = -32768 ... 32767
	`Rn`	Register Rn contains the value which is loaded into the specified register	n = 0 ... 99
Effect	The value specified with n is loaded into the register.		
Example	`N011 #LR1=100` ;Load value 100 into register 1		
Remark	Registers are remanent.		

#AR	**Add to register** – permitted in operating modes: Start/Stop		
`Nn #AR<Register> = <Value>`			
`<Register>`	`n`	Number of the register into which the value is loaded	n = 0 ... 99
`<Value>`	`n`	Value which is loaded into the specified register	n = -32768 ... 32767
	`Rn`	Register Rn contains the value which is loaded into the specified register	n = 0 ... 99
Effect	The contents of the register are added with the specified value.		
Example	`N010 #LR0=0` ;Delete register 0 `N011 #AR0=1` ;Increase register 0 by 1		
Remark	Registers are remanent.		

#TR	**Test register** – permitted in operating modes: Start/Stop		
`Nn #TR<Register> = <Value> <Record number>`			
`<Register>`	`n`	Number of the register, the contents of which are to be compared	n = 0 ... 99
`<Value>`	`n`	Value which is to be compared with the contents of the specified register	n = -32768 ... 32767
	`Rn`	Register Rn contains the value which is to be compared with the contents of the specified register	n = 0 ... 99
`<Record number>`	`n`	Specification of the record number as numerical value	n = 0 ... 999
	`Rn`	Register Rn contains the record number	n = 0 ... 99
Effect	A branch is made to the specified NC record if the register contains the specified value.		
Example	`N010 #TR0=100 350` ;If register 0 = 100, jump to NC record 350 A branch is made to NC record 350 if register 0 contains the value 100.		

5.6 Checking programs

You can check your user programs for syntactical errors.

The following will be checked:

– missing or incorrect line numbering

– correct command words

– correct record structure

– existence of symbolic identifiers

– value ranges.

To check the syntax in programs:

1. Make sure that the program window of the program to be compiled is active.

2. Select [Syntax check] from the [Compile] menu or click on the “Syntax check” button.

3. The progress of the syntax check will be displayed in the “Compile” window. Wait until the checking procedure is complete.

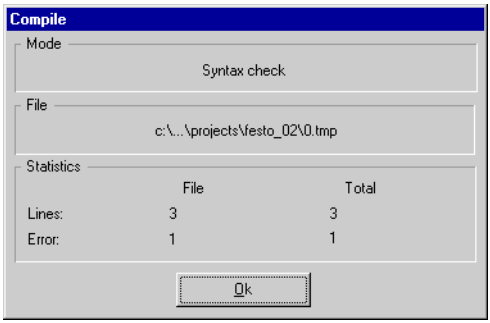


Fig. 5/20: Syntax checking

4. Click “OK” in the “Compile” window to confirm the completed check.

5. Check the message window. Rectify any errors and repeat the syntax check.

Message window

The result of the syntax check will be shown in the message window.

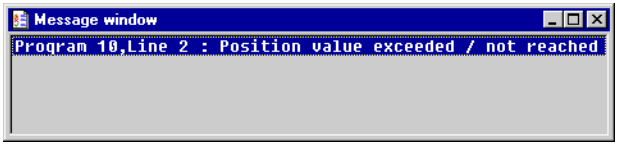


Fig. 5/21: Message window

The messages displayed always start with the program number and the line in which this error occurs. Then the type of error will be described or the message “No errors” will be shown if compilation is error-free.

If you double-click on a line in the message window, the relevant program window will automatically be activated and the cursor will be located on the line in which the error occurs.

The line, in which the selected fault occurs, is marked with an arrow.

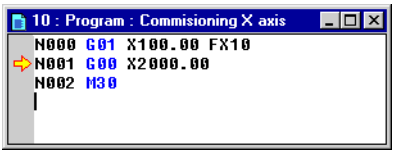


Fig. 5/22: Program window

The following table lists all possible Syntax check messages in alphabetical order:

Message	Description/Remedy
Compilation aborted Too many errors	The compilation was cancelled as there were too many errors. Rectify the errors occurring before this message appeared and re-compile.
Input file cannot be read (fatal error)	A file necessary for compilation cannot be read. Check Windows System Resources, close applications you do not require and check your hard disk for errors.
Invalid program type	The program file to be compiled does not conform to the WinPISA format. It is possibly defective or has been processed with another editor. Open the program window and save the program. If the file cannot be opened, you must delete it using the Explorer and re-create it in WinPISA.
No error	This program contains no compilation or syntax errors
Non-permitted channel for analogue nominal value	With command “M14” you have entered a non-permitted channel for an analogue nominal value after the axis identifier. Permitted channels for analogue nominal values: 1 ... 4
Non-permitted command. Analogue module is not present	You have used one of the commands “M10,” “M11”, ”M13” or “M14” for the analogue reference value. However, no analogue input module has been configured in the SPC200 in your project.
Non-permitted flag	You have specified an invalid flag in one of the commands “#S..”, “#R..”, “#T..”, “#TN..” (set one bit operand, reset, test to 1 or 0 signal). Valid flags: FX0 .. FX99 [FY] (0 = 100 % of max. defined speed)
Non-permitted input	With one of the commands “#T..”, “#TN..” (Test single-bit operand for 1 or 0-signal) you have specified a non-permitted input address. Permitted addresses see section 5.2.
Not enough memory for scanner	A problem has occurred in the internal memory management. Check Windows System Resources and close applications you do not require. Re-start Windows if necessary
Not enough memory for the Opcode table	A problem has occurred in internal memory management. Check Windows System Resources and close applications you do not require. Re-start Windows if necessary

Message	Description/Remedy
Non-permitted mode for analogue reference value	You have specified an invalid mode for the analogue nominal value in command “M13”. Valid modes: X0 .. X4 [Y , Z, U]
Non-permitted mode for reference travel	With command G74 you have entered a non-permitted reference travel mode after the axis identifier. Permitted reference travel modes: 0 ... 4
Non-permitted output	With one of the commands “#S..”, “R..”, “#T..”, “#TN..” (Set single-bit operand, Reset, Test for 1 or 0-signal) you have specified a non-permitted output address. Permitted addresses see section 5.2.
Non-permitted per cent specification	You have specified an invalid percentage in command “G08”, “G09” or “M39” (acceleration for approach or brake ramp, reserved for later expansion). Valid range: 0 .. 99 (0 = 100 %)
Non-permitted position register value	You have specified an invalid position register number in a position command. Valid position registers: X@0 .. X@99 [Y@.., Z@.., U@..]
Non-permitted quality class	You have specified an invalid quality class in command “G61” (set quality class). Valid quality classes: 0 ... 6
Number of records too large	The permitted maximum number of 1000 records is exceeded in this program. Optimize your program or break it down into two programs and call one of them as a subprogram.
Non-permitted register value	You have specified an invalid register number in one of the commands “L..”, “#LR..”, “#T..”, “#A..” (call up subprogram, load, test, add register). Valid registers: R0 ... R99
Non-permitted scaling value	You have specified an invalid scaling factor in command “M10” (activate analogue reference value input). Valid range: 0.1 ... 9999.9
Non-permitted speed value	You have specified an invalid speed in one of the commands “G01”, “G02” (approach position with defined speed or approach smoothly). Valid range: FX0 ... FX99 [FY, FZ, FU] (0 = 100 % of defined maximum speed)

Message	Description/Remedy
Non-permitted time value	You have specified an invalid dwell time in command “G04” (dwell time). Valid range: 0 ... 9999
Object file cannot be written	A file necessary for compilation cannot be written. Check Windows System Resources, close applications you do not require and check your hard disk for errors.
Output file cannot be written (fatal error)	A file necessary for compilation cannot be written. Check Windows System Resources, close applications you do not require and check your hard disk for errors.
Parser Stack overflow	A problem has occurred in internal memory management. Check Windows System Resources and close applications you do not require. Re-start Windows if necessary.
Position list file cannot be read (fatal error)	A file necessary for compilation cannot be read. Check Windows System Resources, close applications you do not require and check your hard disk for errors.
Position value exceeded/ not reached	You have entered a position value greater than the configured measurement system or cylinder length in one of the position commands “G00”, “G01”, “G02”. This value can also originate in the position list.
Program file cannot be read (fatal error)	A file necessary for compilation cannot be read. Check Windows System Resources, close applications you do not require and check your hard disk for errors.
Range limit exceeded	You have exceeded the limit for the register in one of the commands “#LR..”, “#TR..”, “#A” (load, test, add register). Range: -32767 ... 32767
Record number is not ascending	Record numbering does not increase continuously in your program. Apply numbering.
Specify unknown jump destination	You have programmed a Go To command to a record number which doesn’t exist. Check the record numbers and the Go To command.
Syntax error	The NC record displayed does not conform to the syntactical rules. Check the record against the command overview or the record structures.
Unknown character	The NC record given contains an invalid character. Valid characters are all alphanumerics and the characters “ + - . ; # @ ”.

Message	Description/Remedy
Unknown symbol or designator	An NC word does not conform to the command syntax nor is it contained in the position list. Enter a valid command or a symbol from the position list.
Userbreak	You have cancelled the compilation.

5.7 Compiling programs

The programs, position list and system settings are compiled into the internal command syntax of the SPC200 during compilation. This prepares the data for the SPC200 and the data can now be downloaded to the SPC200.

A condition for compilation is that modifications to the programs are saved.

The syntax of the programs is automatically checked during compilation. Any errors found are displayed as for the syntax check and prevent compilation. In this event, remedy the errors and re-start the compilation.

Only error-free compiled project components can be downloaded to the SPC200.

Compiling the current program

You can compile a single program whilst you are editing it in the program window.

To compile a single program:

1. Make sure that the program window of the program to be compiled is active.

2. Select [Save] from the [File] menu or click on the “Save active window” button to save the modifications.

3. Select [Program] from the [Compile] menu, or click on the “Compile program” button.
4. Compilation progress is shown in the “Compile” window. Wait until the process is complete.
5. Click “OK” in the “Compile” window to confirm the completed check and compilation.

6. Check the message window. If errors are displayed, these can be remedied and compilation repeated.

WinPISA opens the relevant program and jumps to the relevant program line when you double-click on a message in the message window.

Compiling several programs

You can select one or more unopened programs for compilation as an alternative to compiling a single program.

To compile one or more programs:

1. Select [Programs] from the [Compile] menu or click on the “Compile selected programs” button.
2. Select one or more programs from “Program list project” in the “Program list” dialogue window. Check the “All” check box to select all programs.
3. Click “Compile” to start the compilation.

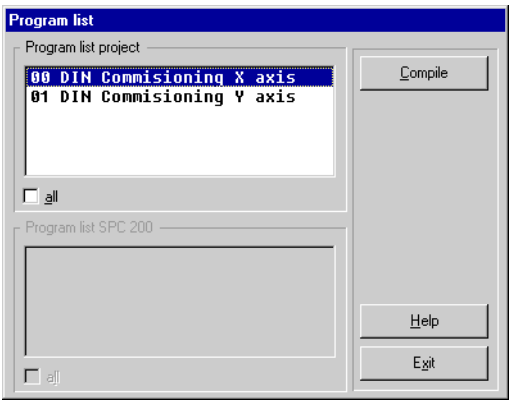


Fig. 5/23: Compiling programs

4. Compilation progress is shown in the “Compile” window. Wait until the process is complete.
5. Click “OK” in the “Compile” window to confirm the completed check and compilation.
6. Check the message window. If errors are displayed, these can be remedied and compilation repeated.

WinPISA opens the relevant program and jumps to the relevant program line when you double-click on a message in the message window.

Compiling a project

You can prepare all the components of a project for downloading to the SPC200 using the [Compile] [Project] command. These are the position list and the system parameters of the configured axes in addition to the programs.

The programs and the position list must previously have been saved for this function.

To compile the whole project:

1. Save the project using [Save project] in the [File] menu.

2. Select [Project] from the [Compile] menu or click on the “Compile project” button.
3. Compilation progress is shown in the “Compile” window. Wait until the process is complete.
4. Click “OK” in the “Compile” window to confirm the completed check and compilation.
5. Check the message window. If errors are displayed, these can be remedied and compilation repeated.

WinPISA opens the relevant program and jumps to the relevant program line when you double-click on a message in the message window.

5.8 Downloading programs to the SPC200 and starting up

Download programs to the SPC200 if you have made modifications to programs in WinPISA.

Programs must have been compiled without error before they can be downloaded.

The SPC200 must be connected to the PC (see Online mode) for programs to be downloaded to it.

To download programs to the SPC200:

1. Select [Online mode] from the [Online] menu or click on the “Online mode on” button in the toolbar to activate Online mode.
2. Select [Programs] from the [Online] [Download] menu.
3. Select one or more programs from “Program list project” in the “Program list” dialogue window. Check the “All” check box to select all programs.

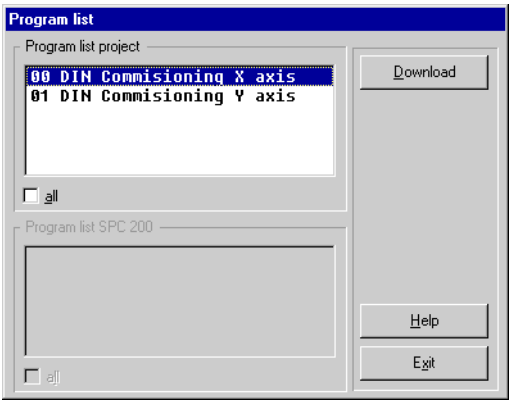


Fig. 5/24: Downloading programs

4. Download the selected programs to the SPC200 using “Download”.

5. The progress of the transmission will be displayed in a window. Wait until the process is complete.

The two bars show the progress of the transmission as a percentage. The upper bar shows the progress for the whole project, the lower bar shows the progress for the project component currently being transmitted. This is shown under “Components”.

If an error occurs during transmission, acknowledge the message and repeat the download.

Once user programs have been downloaded to the SPC200 they become available for the positioning system and can be started.

There are various ways of starting a program.

– via I/O signals (see system manual for the SPC200),

– with the control panel (see system manual for the SPC200),

– in Debug mode in WinPISA (see chapter 6).

Further instructions on testing and starting programs can be found in chapter 6 as well as in the user manual for the SPC200.

Diagnostics and optimization

Chapter 6

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Contents of this chapter

WinPISA offers extensive and user-friendly possibilities of diagnosing, treating errors and optimizing the SPC200. The following possibilities are available and are described in this chapter:

- Errors which occur in online mode are displayed in clear text.
- The function “Status display” shows the system status of the connected SPC200.
- Monitoring of the flags and registers as well as the inputs and outputs (bit and byte operands) is carried out with the function “Observe”.
- With the function “Test mode” individual bit and byte operands (also inputs) can be manipulated for test and diagnostic purposes.
- With the Debug mode programs can be checked using measured values in both single-step mode and continuous mode.
- The optimization of positions in the position list.
- The judging of positioning procedures with the aid of the graphic representation of registered values (for optimizing the positioning behaviour).

Further information

The LEDs on the SPC200 and the connected field devices show directly configuration errors, hardware errors, string errors, etc. The control panel shows error messages coded in the form of a hexadecimal number. Information on the LED functions and fault messages can be found in the system manual for the SPC200 or in the manual for the relevant module.

6.1 Online status display

The ”Online Status Display” function shows all important system and axis statuses directly above the status bar in the WinPISA program window when online mode is active.

Fig. 6/1: Online status display

Elements of the online status display		
Button for calling the status display		
Status:	Direct call of ”Status display” window	
Controller-specific status displays (see control signals/record number)		
Enable	green	ENABLE signal present
Enable	grey	ENABLE signal absent
Ready	green	READY signal present
Ready	grey	READY signal absent
Stop	green	STOP signal present
Stop	grey	STOP signal absent
Error	red	ERROR message present
Error	green	No error message present
Run	green	Program is running
Run	grey	Program has stopped

Elements of the online status display		
Axis-specific status displays "X:", "Y:", "Z:", "U:"		
Ref	red	Reference absent
Ref	green	Reference is valid
Ref	grey	No referencing required
I_stat	yellow	Warning: static identification missing
I_stat	green	Static identification run
I_stat	grey	No static identification (stepper motor)
I_dyn	red	Warning: dynamic identification absent
I_dyn	green	Dynamic identification run
I_dyn	grey	No dynamic identification required (stepper motor)

The display is refreshed at intervals of about 0.1 ... 0.2 s. The display is not refreshed during a download operation.

6.2 Status display

WinPISA's status display provides a clear representation of the most important system data.

The tabs in the "Status display" dialogue window contain information on:

- the axis selected
- the controller of the axis selected (only pneumatic axes)
- the current error message as well as the contents of the error stack
- the status of the SPC200 connected (system)
- the status of the field bus connection (only if there is a field bus module; information on this can be found in the manual for the relevant field bus module)
- effective setpoint values for speed, acceleration and deceleration.

To open the "Status display" window:

1. Select [Online mode] from the [Online] menu or click on the "Online mode on" button in the toolbar to activate Online mode.
2. Select [Status display] from the [Online] [Diagnosis] menu.

The window "Status display" will open with the appropriate tabs.

Axis status

The “Axis” tab shows information on the axis selected.

Field	Meaning
Reference position	Reference position of the axis.
Current position	Current position of the axis.
Control error [1]	Deviation between the current value and the reference value.
Tolerance [1]	Positioning tolerance set for the axis.
Program A	Program number of the active program of task A. Depending on representation: – active text (standard: black): program started – inactive text (standard: grey): program stopped
Record A	Current record number of the active program in Task A.
Program B	Program number of the active program of task B (representation as program A).
Record B	Current record number Task B.
[1] Display only with pneumatic axes	

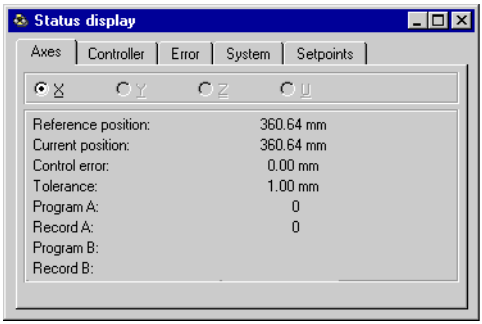


Fig. 6/1: Axis status

Controller status

The “Controller” tab shows information on the closed loop controller of the axis selected.
The “Controller” tab is shown only for pneumatic axes.

Field	Meaning
Gain factor	Set gain factor for the axis.
Damping factor	Set damping factor for the axis.
Signal filter factor	Set signal filter factor for the axis.
Amplitude width	Amount of overswing in the last positioning process carried out.
Positioning time	Time to achieve the last reference position.
Time error	0 = No error 1 = During the last positioning procedure the tolerance window was quitted after Motion Complete (MC). 2 = As with 1, but with double tolerance window.
Motion Complete	Shows the status of the motion complete output (MC) for the selected axis. When all axes of a positioning command send MC, the appropriate system output MC_A /B will be set.
Static control error	Deviation remaining between the reference and current positions in the last positioning process.

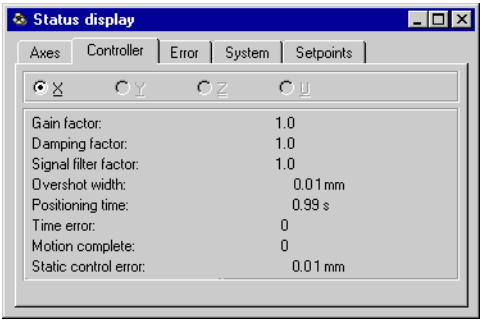


Fig. 6/2: Controller status

Error status

The errors occurring on the SPC200 are shown in the “Error” tab.

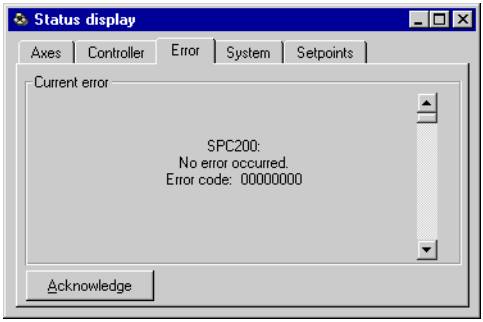


Fig. 6/3: Error status

During operation the last 15 errors to occur (error stack) will be saved.

The errors will be shown in a list: first the current error, then the errors in the error stack.
You can use the scroll bar to page between the errors. At the top of the list, “Current” will be shown for the current error; “Error stack [..]” will be shown for the previous errors. The number in “[..]” indicates the sequence of the errors saved.

You can acknowledge the current error with “Acknowledge”.

Explanations of the faults can be found in the system manual for the SPC200.

System status

The “System” tab contains general information regarding the system on the connected SPC200.

Field	Meaning
Operating mode	Set operating mode of the SPC200
Software version [1]	Version number of the operating system
Controller version [1]	Version number of the controller
Start program A	Program number of the start program of task A.
Start program B	Program number of the start program of task B.
Ident. (static) [2]	Display, whether the static identification for the current axis has been carried out.
Ident. (dynamic) [2]	Display, whether the dynamic identification for the current axis has been carried out.
Reference travel [3]	Display, whether the reference travel for the current axis has been carried out.

[1] The version depending on the selected axis is shown:
– axis on the 1st. axis interface string: Basic unit
– axis on the 2nd. axis interface string: Sub-controller module
– stepping motor axis: Stepping motor indexer module
[2] Display only with pneumatic axes
[3] Display only with electric axes

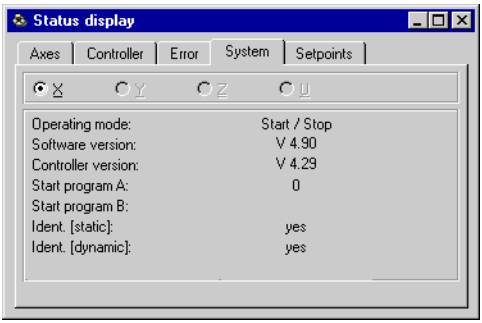


Fig. 6/4: System status

Field bus

The ”Field bus” tab contains information about the field bus connection; see description of the field bus module used.

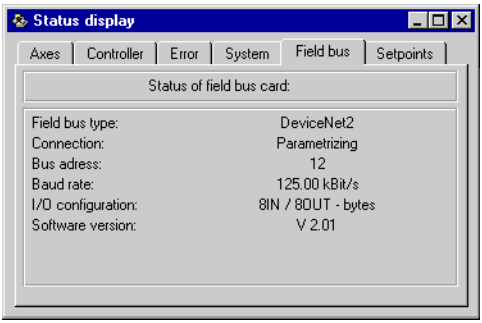


Fig. 6/5: Field bus module (example DeviceNet2)

Setpoints

The ”Setpoints” tab contains information on both the specified (in the NC program) and the actual effective setpoint values for speed, acceleration and deceleration for the selected axis, depending on the current or last-run positioning set. This allows checking of set values and values actually used by the controller, e.g. if the final speed for traverse commands is not reached (system overload).
Modify the set values accordingly in this case.

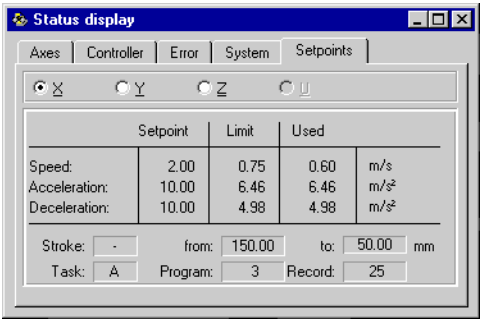


Fig. 6/6: Setpoint status (example G01 command when dynamic identification is complete)

Value	Description
Set	The column shows the specified setpoint values for speed, acceleration and deceleration of the current or last-run traverse command (specified by the current or last traverse command in the NC program). Display dependent on traverse command: – G00: No display, see Fig. 6/7 ”Setpoint values with G00”. Positioning tasks with G00 always run with the limit values; see under ”Limit”. – G01: Setpoint values equate to specification of the respective traverse command, see above, through the current or last traverse command. – G02: As with G01. Note: For G02 commands, the top acceleration is displayed. For details, see explanation on the G02 command, section 5.5. – M10: dependent on mode: Mode 0, 1: Setpoint values not relevant – display not refreshed. Mode 2 ...4: Set values as for G00, G01, G02. – G25: Only the setpoint values of the first traverse command after the call-up of G25 are shown.
Limit	The column shows the maximum potential values for speed, acceleration and deceleration of the current or last traverse command. When dynamic identification is complete, the determined maximum values for the axis are shown (G00, G01, G02, M10 with mode 2, 3 and 4). There is no active display if dynamic identification is not run, with stepper motor axes, continuous setpoint value specification (M10 with mode 0 or 1), with position-dependent switching to next record (G25) and with very small strokes (typ. ‹5 mm). In this case, the values parameterised in the application data (shown in grey) are displayed, see Fig. 6/8 below ”Setpoint values without dynamic identification”.
Used	The column shows the values used for speed, acceleration and deceleration of the current or last traverse command. This is the lesser value from the ”Set” and ”Limit” columns.
Stroke	NC command from the last executed traverse command G00, G01, G02. With M10, the display shown depends on the setpoint value mode: – Mode 0, 1: No display – Mode 2 / 3 / 4: As for G00, G01, G02. The start and end position are displayed under ”from” and ”to”.
Task/Program/Record	Task, program number and record number of the traverse command to which the displayed setpoint values refer.

Examples:

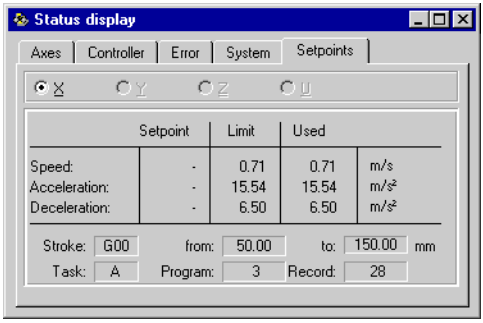


Fig. 6/7: Setpoint values with G00

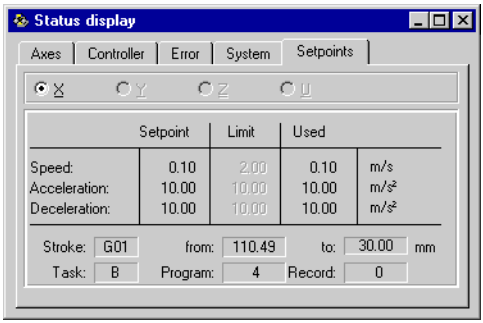


Fig. 6/8: Setpoint values without dynamic identification

6.3 Observe operands

For observing the bit and byte operands WinPISA offers various menu Commands in the submenu [Online] [Observe]. These open appropriate observation windows for various operands.

The status of the bit operands is shown in the observation windows by means of check boxes. These have the following meanings:

– an activated check box has a 1-signal,

– a deactivated check box has a 0-signal.

The status of all the outputs, flags and registers can be influenced directly in the observation windows. You can activate the test mode in order to influence the inputs.

The control signals valid for the SPC200 (inputs and outputs for controlling the SPC200), as well as the current specified record number in record selection mode, are also grouped together and shown in a special observation window.

Information on the individual observation windows can be found in the following sections.

6.3.1 Test mode

You can modify the operands directly in the test mode. In the test mode you can modify the input operands shown in the individual observation windows.

The test mode cannot be activated until an observation window is opened. The test mode will end automatically when all observation windows are closed.

Please note
The I/O signals set in WinPISA for sequence control and release of the controller are effective in test mode. All actual input signals applied will be ignored.

To activate the test mode:

1. Select the command [Test mode] in the menu [Online] [Observe] or press key F5.
2. Read the warning displayed. Click “Continue” to activate the test mode; click “Cancel” to cancel the function.

You can recognize the activated test mode by:

– the flashing entry “Test mode active” in all the observation windows
– the display “Test mode active” in the status line
– the tick against the command [Test mode] in the menu [Online] [Observe].

The procedure for modifying the operands in the test mode can be found in the description of the individual observation windows.

Please note
If assignments are activated for the SPC200 configuration in the "Fieldbus I/O", note that it is only practical to change the source operands in test mode.

The assigned target operands always assume the status of the source operands and cannot, therefore, be changed in test mode.

Please note
Note the following behaviour when test mode is closed:

– Changed output operands (digital outputs, registers, flags, position registers) contain the changed status.
– Changed input operands (digital inputs, position set-point values) assume the status of the actually present input operands.

To end the test mode:

- Select the command [Test mode] from the [Online] [Observe] menu
- Press key F5 again
- or close all the observation windows.

A warning message is displayed prior to test mode being closed. Make your selection depending on the structure and status of your positioning system:

Button	Description
Close with stop	Running programs or traversing movements are stopped. A halted program can be continued with START.
Close without stop	Running programs or traversing movements are stopped by WinPISA. Ensure that changed input operands do not trigger any unintentional movements.
Cancel	Test mode is not closed.

When the Position setpointl value window is open, a second prompt appears for security reasons.

6.3.2 Observing bit and byte operands

The following operands can be observed or influenced in an appropriate observation window:

– the position register

– registers

– flags

– inputs and outputs on the individual modules.

Observe the position register

You can display the contents of the position register as follows:

- Select the command [..-axis] in the menu [Online] [Observe] [Position register] in order to display the position register of the relevant axis.

The contents of the individual registers for the axes selected are shown in a list under ..-axis in the window “Position register”.

You can modify the contents of individual position registers as follows:

1. Select the position register, which you wish to modify, from the list in the window “Position register”.
2. The selected position register will be shown under the list. Enter the desired register contents in this field (“@..:”).
3. Press ENTER to confirm your entry.

The value entered will then be written into the position register of the relevant axis.

Tracing the registers

To display the content of the register:

- Select [Register] from the [Online] [Observe] menu.

The contents of the various registers will be displayed in a list box in the “Register” window.

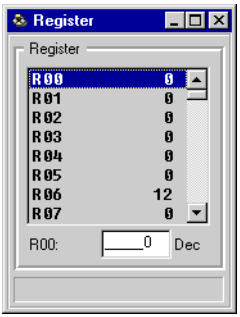


Fig. 6/9: Tracing the registers

You can modify the contents of individual registers as follows:

1. Select the register you wish to modify from the list box in the “Register” dialogue window.
2. The selected register will be shown under the list. Enter the desired register contents in this field (“R..:”) as a decimal number.
3. Press ENTER to confirm your entry.

The value entered will then be written into the register.

Tracing the flags

To display the status of flags:

- Select [Flag] from the [Online] [Observe] menu.

The status of flags F0 to F63 is displayed in check boxes in the “Flag” dialogue window. Set flags (logic “1”) are shown by activated check boxes. In addition, flags F0 to F31 and F32 to F63 are displayed as hexadecimal flag words.

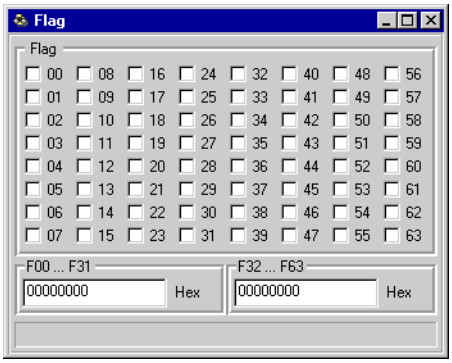


Fig. 6/10: Tracing the flags

You can modify the contents of the flags as follows:

- In order to modify an individual flag, click the relevant check box or select this and press the SPACER key.
- In order to modify several flags, enter the (hexadecimal) input or output word. Confirm this with the ENTER KEY.

Tracing I/Os

You can trace the status of the available inputs and outputs. Depending on the hardware configuration, these are:

Menu command	Description
[I/O module] [Address range ...] [1)]	Inputs and outputs on the I/O module with the appropriate address range
[Field bus module] [Address range ...] [1)]	Inputs and outputs on the field bus module with the appropriate address range
[I/O module in 1st. AIF string] [1)]	Inputs and outputs of the modules on the 1st. axis interface string (address range 1.0 ... 1.15)
[I/O module in 2nd. AIF string] [1)]	Inputs and outputs of the modules on the 2nd. axis interface string (address range 3.0 ... 3.15)
[Stepping motor module] [1)]	Inputs of the stepping motor module
[1)] The menu commands for non-available modules are inactive.	

The status of the inputs and outputs are shown by means of check boxes in the windows for I/O observation. In addition, the inputs and outputs are summarized as input and output words in hexadecimal format.

The addresses which cannot be modified are represented as inactive (grey).

To display the status of the inputs and outputs:

- Select the appropriate command, depending on the desired address range, in the menu [Online] [Observe]. The relevant observation window will be shown.

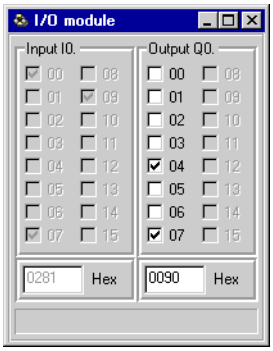


Fig. 6/11: Tracing I/Os

You can modify the status of the outputs as follows:

- In order to modify an individual output, click the relevant check box or select this and press the SPACER key.
- In order to modify several outputs, enter the (hexadecimal) input or output word. Confirm this with the ENTER KEY.

The status of the READY output and the RC and ACK outputs used by the system (RC_A, RC_B, ACK_A, ACK_B, only in record selection mode) will be continually updated by the operating system and cannot, therefore, be influenced.

The status of the inputs can be modified in test mode. Proceed here as when modifying the outputs.

6.3.3 Control signals/record numbers

WinPISA shows you the states of the inputs and outputs valid during program processing for controlling the SPC200. The available control I/Os depend on the operating mode. In the record selection mode the current specified record number is also shown.

Detailed instructions on the control signals can be found in the system manual for the SPC200.

The control I/Os are assigned either to the address range of the first I/O module or to the field bus module depending on the configuration.

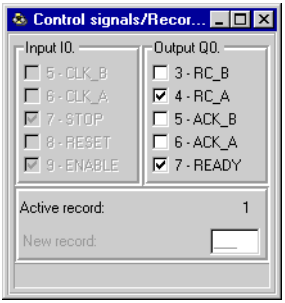


Fig. 6/12: Control signals/record numbers (e.g. record selection)

You can display the window Control signals/record numbers as follows:

- Without field bus module:
  Select the command [Control signals/record numbers] in the menu [Online] [Observe] [I/O module].
- With field bus module:
  Select the command [Control signals/record numbers] in the menu [Online] [Observe] [Field bus module].

Control outputs used by the SPC200 cannot be influenced. In test mode, you can enter the current record number in record selection mode and transfer it by pressing the ENTER key.

6.3.4 Position setpoint values

With configuration ”Nominal value input via field bus (channel 5)”, WinPISA shows you the current position setpoint values.

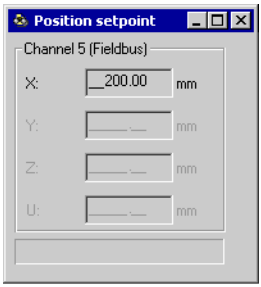


Fig. 6/13: ”Position setpoint”

The position setpoint values are always absolute values and refer to the project zero point.

They indicate the position setpoint value window:

- Select the [Position setpoint] command in the [Online] [Observe] [Fieldbus module] menu.

Setpoint values specified via analogue input modules cannot be displayed.

In test mode, the position setpoint values can be entered and accepted using the INPUT KEY.

Please note
Position setpoint values changed in test mode are immediately valid.

A direct axis movement may take place depending on the selected setpoint value mode (see M14).

Caution
The actually present position setpoint values become effective again when test mode is closed.

A separate prompt therefore appears, see Test mode.

A detailed description of the setpoint value specification can be found under M10.

6.3.5 Selecting the available observation windows

WinPISA offers a selection window for user-friendly opening and closing of the available observation windows. You can open or close the available windows by activating or deactivating the relevant check boxes. The test mode can also be activated.

You can display the window “Select observation window” as follows:

- Select the command [Select] in the menu [Online] [Observe].

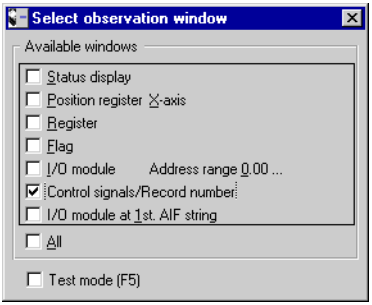


Fig. 6/14: Selecting the observation window

6.4 Optimizing positions

You can determine positions in the position register directly in WinPISA. You can move the axis and accept the current axis position into a position register.

Warning
This function will set one or more axes of the system in motion.

Make sure that nobody can place his/her hand in the path of the moving mass.

With the command [Optimize position] you can modify the position register in the SPC200. The values of the position list in the relevant project remain unchanged.

If you wish to save modifications to the position registers in a WinPISA project, you must first upload the position register from the SPC200. Then save the position list.

Control signals required (only for moving the axis with the command buttons):
1-signal at ENABLE, STOP and READY.

You can transfer the position of an axis into a position register as follows:

1. Select [Online mode] from the [Online] menu, or click on the “Online mode on” button in the toolbar to activate Online mode.
2. Select [Optimize position] from the [Online] menu.
3. Read the warning displayed. Click “Continue” to open the “Optimize position” dialogue window; click “Cancel” to cancel the function.

4. Select the axis for which you wish to accept the current axis position from the “Optimize position” dialogue window.

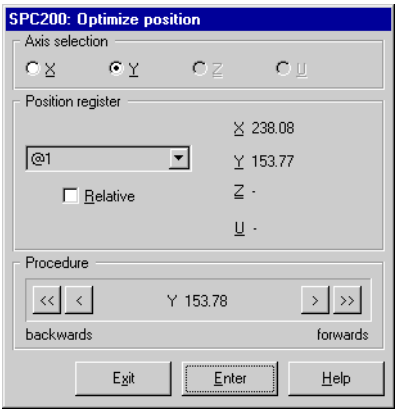


Fig. 6/15: Optimizing the position

5. Select the position register, in which you wish to enter a position, under “Position register”.

6. Move the axis with the buttons under “Procedure” to the desired position. The actual position will be shown under “Procedure”.

Button	Moves the axis selected ...
<<	... continuously in a negative direction.
<	... by 2 x the specified positioning tolerance in a negative direction.
>	... by 2 x the specified positioning tolerance in a positive direction.
>>	... continuously in a positive direction.

You can move the axis to the desired position by hand if the system is depressurized.

7. Accept the new axis position into the position list with “Enter”. The position is entered after the axis identifier next to “Position Register”

8. If you wish to ascertain a relative position, move to a starting position and activate the check box “Relative” under “Position register”. The position display under “Procedure” will be reset to the value “0.00” and in further movements of the axis will show the position relative to the start position.

9. Repeat steps 4 to 6 if you wish to optimize further positions.

10. Close the dialogue window “Optimize position” with “Exit”.

6.5 Control axes

WinPISA allows you to check programs and record measurements. The SPC200 program is controlled and traced to perform these tasks.

6.5.1 Debug mode

A program is uploaded from the SPC200 and displayed in a Debug window where it can be tested. You can then execute the NC program one step at a time or in continuous operation and record measurement values for a defined range of the program.

Warning
The axes of the system can start to move in Debug mode.

Any running programs will be stopped and reset.

Keep clear of the positioning range and provide warning signs to inform people of the dangers of being near the moving actuators.

The SPC200 is controlled by WinPISA once a program has been uploaded and displayed in the Debug window. This is described as Debug mode.

The SPC200 in Debug mode

The following peculiarities apply in Debug mode:

– The program tested in Debug mode is processed in task A. The appropriate I/O signals of task A are effective.

– During the testing of programs for the Record Selection mode, the NC records in the debug window are selected and started with the command [Single step]. Sequence control through the inputs RECBIT.. and the input CLK_A is still effective. However, this cannot be displayed in the debug window.

– When programs are being tested for Start/Stop mode, the individual records are activated and started by WinPISA in the SPC200. WinPISA also takes into account here jumps and any I/O signals present. The individual NC records can be started one after the other when there is a positive edge at the START input. However, this cannot be shown in the Debug window.

Caution
If an error occurs in transmission in the operating mode Start/Stop during Debug mode, WinPISA can no longer reset the sequence control transferred from the SPC200.

If errors occur, make sure that the SPC200 reacts as expected when the Debug mode is exited. If necessary, restore the normal status with the [Program reset] command in the [Online] menu.

Please note
During the Debug mode WinPISA takes over the sequence control of the SPC200.

This results in a different run time performance of the program sequence.

Please note
It is not possible to continue a positioning procedure after a stop signal in Debug mode. If you use the NC command G91, an absolute position (G90) must be reached after each stop.

Control signals required
1-signal at ENABLE, STOP and READY.

To open a program in the Debug window:

1. Select [Online mode] from the [Online] menu, or click on the “Online mode on” button in the toolbar to activate Online mode.
2. Select [Control axis] from the [Online] menu. The available programs will be uploaded from the SPC200.
3. Select the program you wish to test in Debug mode from the “Program selection” dialogue window and click “OK” to confirm your selection.
4. Read the warning displayed. Click “Continue” to confirm or cancel the process by clicking on “Cancel”. The program will be uploaded from the SPC200 and displayed in the Debug window.

Debug window

The Debug window shows the NC program in the form in which it is stored in the SPC200.

The first NC record is selected. Move the highlight with the ARROW KEYS or click on the desired NC record with the mouse to place the record pointer on another NC record.

The NC record currently being executed by the SPC200 is identified by “ --->...<--- ” in the Debug window.

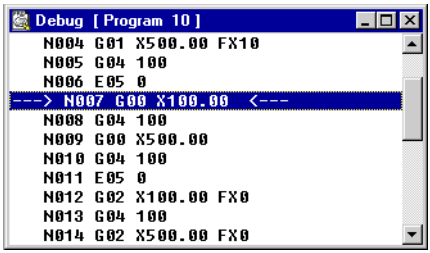


Fig. 6/16: Debug window program 10

Testing programs

Continuous operation

The function “Continuous operation” is only possible in the Start/Stop mode. The individual NC records of the program are executed one after the other as programs are tested in continuous operation. Programmed jumps are taken into consideration and executed.

To start a program in continuous operation:

1. Select the NC record with which you wish to start continuous operation in the Debug window.

2. Select [Start continuous run] from the [Online] [Control commands] menu or click on the “Start continuous run” button in the toolbar to start continuous operation.

Single record

Single NC records in an NC program can be executed in single steps for testing purposes.

To execute a single NC record:

1. Select the desired NC record from the Debug window.

2. Start execution of the selected NC record step with [Execute step] from the [Online] [Control commands] menu or by clicking on the “Execute step” button in the toolbar.

Once the selected NC record has been executed, the record pointer will jump to the next record in Start/Stop mode. In Record select mode you should select the next record to be executed.

Please note
When a subprogram is accessed it always runs continuously, providing the function “Load subprogram” is not activated.

Stopping a program

To stop a program in continuous operation:

- Stop the execution of the program in the menu [Online] [Control commands] with the command [Stop axis] or click the button “Stop axis” in the toolbar.

Load subprogram

The function “Loading subprograms” is only possible in the Start/Stop mode.

In the Debug mode subprograms are only shown in the Debug window when the function “Load subprogram” is activated.

- Activate the uploading of subprograms in the menu [Online] [Control commands] with the command [Load subprogram] or click the button “Load subprogram”... in the toolbar.

The subprogram will be uploaded from the SPC200 and displayed in the Debug window. You can execute single steps or start a continuous run to test the subprogram, just as the main program.

The calling program will automatically be reloaded if a record in the subprogram containing command “M02” is executed.

6.5.2 Recording measurement values

WinPISA offers the facility for recording measurement values for positioning processes in Debug mode. The recorded measurement values allow you to make an exact assessment of the positioning behaviour of the positioning system.

Please note
During the Debug mode WinPISA takes over the sequence control of the SPC200.

This results in a different run time performance of the program sequence.

Measurement values can only be recorded for the pneumatic axes.

Configuring the measurement

When configuring the recording of the measured value, you must set the type of measurement. To do this, select the desired measured variables for the individual axes as well as the scanning time for the measurement.

Configure the measurement as follows:

1. Select the command [Configure] in the menu [Online] [Measurement].
2. Select the axes, for which measurements are to be made under “Activate for axes” in the dialogue window “Configure measurement”.
3. All available measured variables will be shown under “Measurable data”. The settings for the possible axes X, Y, Z and U will each be shown on a tab card under “Configuration for axis”.

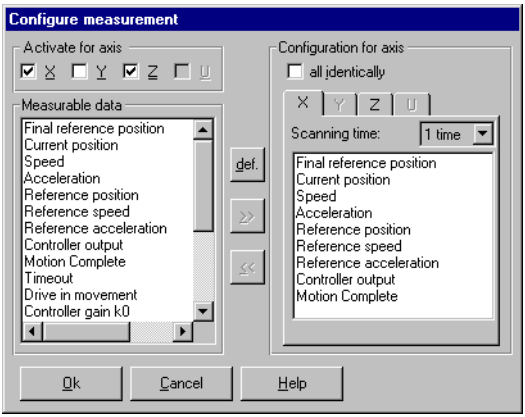


Fig. 6/17: Configuring the measurement

- Set the recording cycle in the list box “Scanning time”. “1 time” means that measured values are recorded at each system interval. “10 times” means that values are recorded only every 10 system intervals.
- In order to add a measured variable to the recording, select it under “Measurable data” and transfer it to the current tab card of the axis with the button “>>”. Maximum 10 measured variables per axis can be recorded.
- In order to remove a measured variable from the recording, select it under “Configuration for axis” and remove it from the current tab card of the axis with the button “<<”.
- With the “Default” button, you can reset all measured variables to the standard setting (the first 9 measured values).
- Activate the check box “All identical” in order to define the same settings for all the axes. The settings in the current tab will be used.

4. Confirm your entries with “OK”.

The settings remain valid for all measured value recordings until they are modified again in the dialogue window “Configure measurement”.

Measured variables

The following measured variables can be recorded:

Measured variables	Range	Unit	Description
Final reference position	Position value in positioning range	mm or [°]	Final position of the axis for the current position command
Current position	Position value in positioning range	mm or [°]	Current actual position of the axis
Speed	Maximum speed	m/s or [10^3 °/s]	Current speed of the axis
Acceleration	Maximum acceleration	m/s^2 or [10^3 °/s^2]	Current acceleration of the axis
Reference position	Position value in positioning range	mm or [°]	Current reference position of the axis calculated by the SPC200
Reference speed	± maximum speed	m/s or [10^3 °/s]	Reference speed calculated by the SPC200
Reference acceleration	± maximum acceleration	m/s^2 or [10^3 °/s^2]	Reference acceleration calculated by the SPC200
Controller output signal	-1 ... +1	–	Normalized valve actuating signal: -1 corresponds to 0 V control voltage +1corresponds to 10 V control voltage
Motion Complete	0 or 1	–	Shows the end of the current movement according to the defined quality class: 0 position not (yet) reached 1 position reached

Measured variable	Range	Unit	Description
Timeout	0 or 1	–	Shows whether the positioning time-out has been exceeded without the drive fulfilling the tolerance conditions: 0 positioning timeout not exceeded 1 positioning timeout exceeded
Drive in movement	0 or 1	–	Shows whether the drive moves at a minimum speed: 0 drive at rest 1 drive moving
Following error	–	[mm] or [°]	Deviation between reference position and current position
The further measured variables are intended only for service personnel.			

Recording measurement values

You can record measurement values for one or more axes once you start testing a program in Debug mode. The start and end of measurement can be assigned to any NC record.

Measurement values recording starts as soon as the first record with a starting point is executed. Measurement ends as soon as the first record with a stopping point is executed. Continuous operation is also stopped at this point.

The measurement data will be uploaded from the SPC200 automatically once measurement is completed.

Continuous operation

To record measurement values in continuous operation:

1. Select the NC record at which you wish to start recording measurement values.

2. Select [Set/reset starting point] from the [Online] [Measurement] menu or click on the “Set/reset starting point for measurement” button in the toolbar. The NC record is identified by the character “>>”.

3. Select the NC record at which you wish to end recording measurement values.

4. Select [Set/Delete stopping point] from the [Online] [Measurement] menu to set the stopping point for the measurement, or click on the “Set/delete stopping point for measurement” button in the toolbar. The NC record is identified by the character “**”.

5. Select the NC record at which you wish to start continuous operation.

6. Select [Start continuous run] from the [Online] [Control commands] menu or by click on the “Start continuous run” button in the toolbar to start continuous operation.

Once the measurement values have been uploaded from the SPC200, these become available as “Online measurement data” and can be stored or displayed as a graphic.

Single step

To record measurements in Single Step mode:

1. Select [Single step mode] from the [Online] [Measurement] menu or click on the “Switch on measurement at each single step” button in the toolbar to activate measurement in Single step mode.

2. Select the NC record for which measurement values are to be recorded.

3. Execute the NC record. Do this by selecting [Execute step] from the [Online] [Control axes] menu or by clicking on the “Execute step” button in the toolbar.

   The measurement values for the selected NC record will be recorded.
   The measurement data will be uploaded from the SPC200 automatically once measurement is completed.

Once the measurement values have been uploaded from the SPC200, these become available as “Online measurement data” and can be stored or displayed as a graphic.

Saving the measurement values

You can save the measurement values once they have been uploaded from the SPC200.

You can save the measurement values of the last recording as follows:

1. Select [Save data] from the [Online] [Measurement] menu.
2. Enter a name for the measurement data file in the “Save measurement values” dialogue window.
3. Click “OK” to confirm your entry.

The data saved can later be used for creating graphics.

6.6 Graphic functions

The graphic functions support you in evaluating the positioning behaviour of your system. You can:

– put together recorded and saved measurement values and display them graphically in any form

– measure the displayed curves absolutely or relatively using the data cursor

– save created graphs for documentation or later comparisons

– print graphs.

Recorded measurement values must be available for the creation of a graph. You must therefore first create a measurement value recording for the NC record you wish to display graphically (section 6.5).

6.6.1 Creating graphs with standard data basis

WinPISA offers a range of graphs with standard data basis to enable you to judge the positioning behaviour of positioning systems.

With the aid of these graphs you have a quick overview of the last measurement carried out.

The following standard graphs are available:

Type	Representation
s(t)	Actual value (position) of the axis selected over time.
v(t)	Speed of the axis selected over time.
a(t)	Acceleration of the axis selected over time.
v(s)	Speed of the axis selected over the actual value.

To create a standard graph for the current measurement:

1. Select the graph type from the [Graphic] [Standard] menu (see table).
2. Select the axis for which the standard graph is to be created in the submenu of the function.

The graph created will be displayed in a new graphic window.

6.6.2 Creating new graphs

You can assemble measurement data in any way in a new graphic window.

You can also combine current Online measurement data and saved measurement values when you do this.

To create a new graph:

1. Select [New] from the [Graphic] menu or click on the “Create new graphic” button in the toolbar.
2. Select the measurement data required in the “Data basis” dialogue window. Do this by selecting individual measurement values from “Available measuring data” and allocate these to the individual axes under “Diagram layout” using the buttons under “Assign measuring data”.
3. Click “OK” to confirm your selection. The graph will be displayed in a new graphic window.

All graphs are put together using the same scheme. Information on the elements of the graphic window can be found under “Graphic elements”.

Defining the data basis for a new graph

Collation and assignment of measurement values go to make up the data basis for a graph.

The “Data basis” dialogue window consists of two areas: “Available measuring data” and “Diagram layout”.

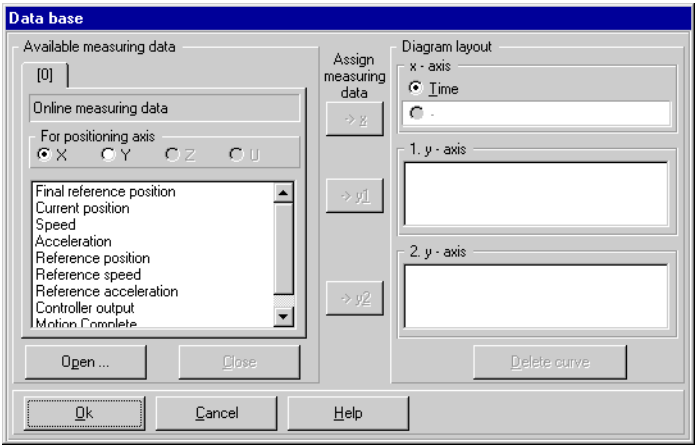


Fig. 6/18: Configuring the graph

Select the measurement data from “Available measuring data”. Tab “[0]” always contains Online measure-ment data, i.e. the measurement data of the current measurement re-cording. Tab [0] (Online measuring data) is empty if no measurements have been recorded in the current WinPISA session.

You can open saved measurement data from earlier measure-ments using the “Open” button. These will each be displayed on an additional tab ([1], [2], etc). Measurement data is se-lected in the “Read measurement data” dialogue window. Select a measurement data file (*.MDA) and click on “OK” to open.

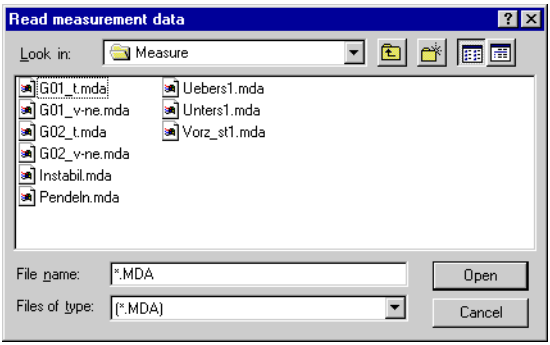


Fig. 6/19: Loading measurement data

Click on the “Close” button to remove the measurement data on the current tab from the “Data basis” dialogue window.

The source of the measurement values will be displayed at the top of the tab. The individual measured variables are listed below this. You can switch to the measurement values for the respective axis using the “X” and “Y” option buttons where measurement values for more than one axis are displayed.

Lay out the measurement variables in the “Diagram layout” area in the way that they will be displayed in the graph.

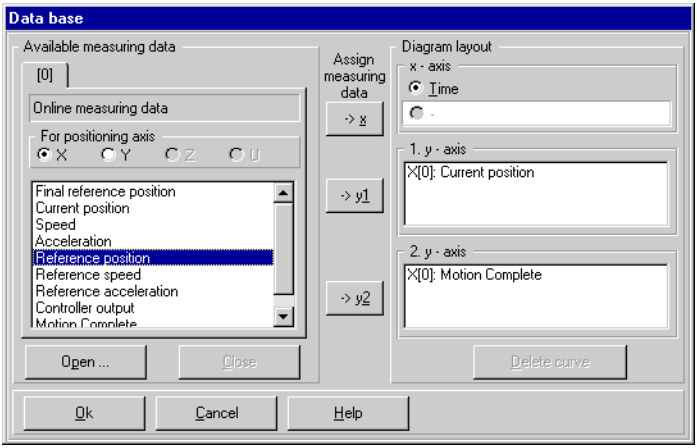


Fig. 6/20: Diagram layout

Specify the unit of measurement for the X-axis (abscissa) of the graph under “X-axis”. Select time or any other measurement variable from the “Existing measurement data” range as the unit of measurement. Assign these values to the X-axis by using the “–>x” button.

Specify the measurement variables to be displayed in the graph as curves in the “1. Y-axis” and “2. Y-axis” fields. You can use two ordinate axes and thus two different scales on each graph by dividing this into two y-axes (ordinates).

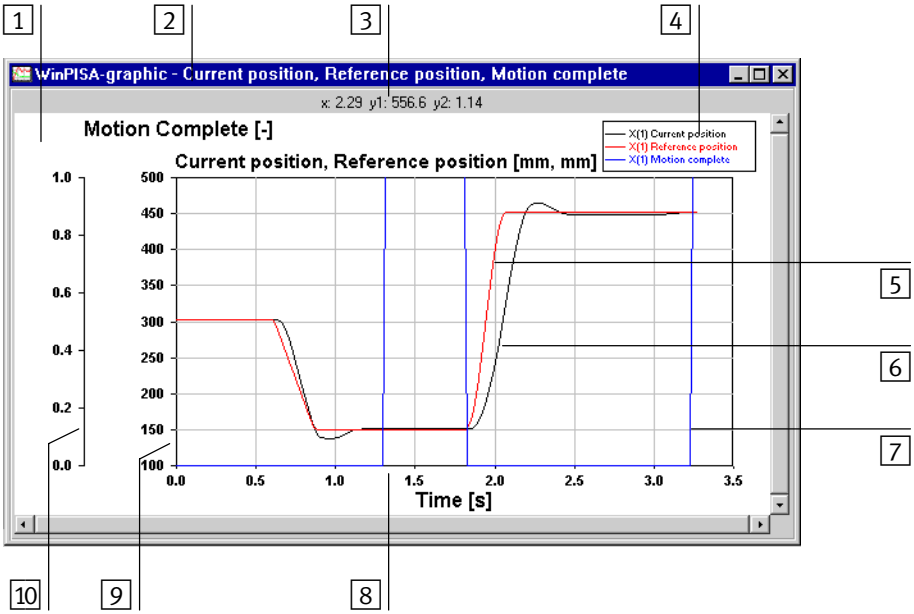
To display a measurement variable, select it from “Available measurement data” and accept it for the axis concerned using “ –>y1” or ” –>y2”.

To remove a measurement variable from the “Diagram layout” area, select this variable and click the “Delete curve” button to remove it.

Click on “OK” to confirm the settings. The graph specified will be displayed in a new graphic window.

6.6.3 Graphic elements

All graphic windows in WinPISA follow the same layout and consist of the following elements:



1 Display area

2 Graphic title

3 Co-ordinate display

4 Legend

5 Curve 1

6 Curve 2

7 Further curves

8 X axis (abscissa axis)

9 y1 axis (first ordinate axis)

10 y2 axis (second ordinate axis)

Fig. 6/21: Graphic window

Explanation of the graphic window elements:

Element	Explanation
Graphic title	You can read the number of the graphic window in the title line as well as the title of the graph in the case of user-defined graphics.
Display area	The curves recorded are displayed in this area using the measurement values determined.
Co-ordinate display	The cursor co-ordinates are displayed in the header line. If the “Data cursor” option is activated, the values displayed will refer to the position of the data cursor, i.e. the co-ordinates of the measurement values determined. The display is relative to the reference cursor specified if a reference cursor is set.
Curve 1	A graph always contains at least one curve using the scale of the first ordinate axis (y1 axis).
Curve 2	You can display a second measurement variable with its own scale by assigning this to the second ordinate axis (y2 axis).
Further curves	You can allocate further curves to both ordinates in addition to the first two curves.
Data cursor	If you activate the display of a data cursor, the co-ordinates displayed will relate to the co-ordinate cross additionally displayed, i.e. the data cursor. This cursor always lies exactly on the measurement point closest to the mouse pointer.
Reference cursor	The current position can be determined as the reference cursor when the data cursor is activated. The co-ordinate display is then relative to the reference cursor specified.
X-axis	The abscissa (or x-axis) of the graph is usually the time axis. The abscissa can also be assigned with any other measurement variable.
y1-Achse	The first ordinate axis (or y1-axis) is scaled with the unit of the first measured row under “1. y-axis” in the dialogue window “Data basis”.
y2-Achse	The second ordinate axis (or y2-axis) is scaled with the unit of the first measured row under “2. y-axis” in the dialogue window “Data basis”.
Legend	Names, colours, line attributes and the data point symbol for the relevant curve shown are represented in the legend.Legend

6.6.4 Modifying graphs

There are different ways of adapting a graph optimally. You can modify the following settings:

- data base
- axis attributes
- curve attributes
- display of a legend.

Data basis

Select [Modify data basis] from the [Graphic] menu to modify the database of the graph in the active graphic window. You can assign measurement values in the “Data basis” dialogue window.

The same options and functions are available here as in creating a new graph (see “Creating new graphs”).

Click “OK” to accept the modifications to the database for the current graph.

Axis attributes

You can modify the range displayed and the scaling of the graph, also the colour and labelling of the axes by changing the axis attributes.

Select [Modify axis attributes] from the [Graphic] menu to modify the settings for the axes in the current graph. Or double-click the appropriate axis.

There is one tab for each axis in the “Axis attributes” dialogue window. Select the tab for the axis you wish to modify.

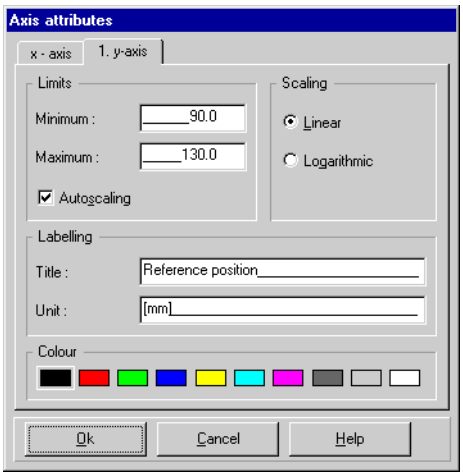


Fig. 6/22: Axis attributes

“Autoscaling” is activated for new graphs under “Limits”. This means that the “Minimum” value and “Maximum” value are automatically determined for the smallest scale value and largest scale value of the axis, respectively. If you want to modify the scaling, enter the smallest value in “Minimum” and the largest value to be displayed in “Maximum”.

You can show the scale for the axis as “Linear” or “Logarithmic” under “Scaling”.

The name and unit of the measurement values assigned are entered in the “Title” and “Unit” fields under “Labelling”. You can overwrite these entries.

You can select a different colour for the axis display under “Colour”.

Click “OK” to accept the modifications made for the current graph.

Curve attributes

By modifying the curve attributes, you can adapt the representation of the individual curves and indicate the measured points with symbols markers (symbols).

Select [Modify curve attributes] from the [Graphic] menu to modify the settings for the axes in the current graph. Alternatively, you can double click the appropriate curve.

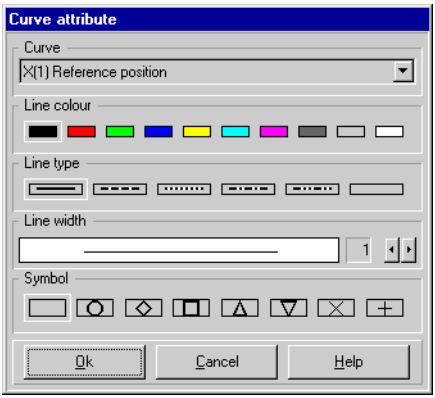


Fig. 6/23: Curve attributes

Select the measurement variable, the curve of which you want to modify, from the “Curve” list box in the “Curve attributes” dialogue window. All additional settings in this dialogue window refer to the curve selected here.

Select a new line colour under “Line colour” for the set curve.

You can select a type style for the line connecting individual measurement points under “Line type”.

A curve can be shown thicker to emphasize it. Use the arrow buttons under “Line width” to modify the line thickness.

The measurement values recorded can be displayed in the graph. Select a marker for the measurement value under “Symbol”.

Click “OK” to accept the changes to the curve attributes for the current graph.

Legend

The curves for the measurement variables are shown in a legend. All curves shown are listed in the legend field with the colour, line type, line width and marker type assigned.

Select the command [Legend] in the menu [Graphic] in order to fade in or fade out the legend shown. Or click on the “Switch off legend in the current graphic” or “... Display ” button.

You can use the mouse to move the legend to any position within the graph.

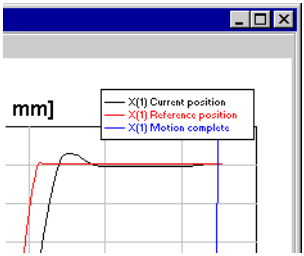


Fig. 6/24: Legend

Zooming

You can enlarge a section of the graph by drawing a frame with the mouse around the section you wish to enlarge. When you release the mouse key, the axes will be rescaled in accordance with the selected section.

Select [Zoom out] from the [Graphic] menu or click on “Restore original scaling” button to display the original size of the graph.

6.6.5 Evaluating graphs

WinPISA enables you to measure displayed curves in order to assess positioning processes. You can use the mouse here as a measuring tool.

Co-ordinate display

Move the mouse pointer to a point on the curve to determine its co-ordinate value in the graph.

You can read off the position of the mouse pointer as an X and Y co-ordinate value in the co-ordinate display. The two Y co-ordinates will be displayed as y1 and y2 values where the graph contains two Y axes.

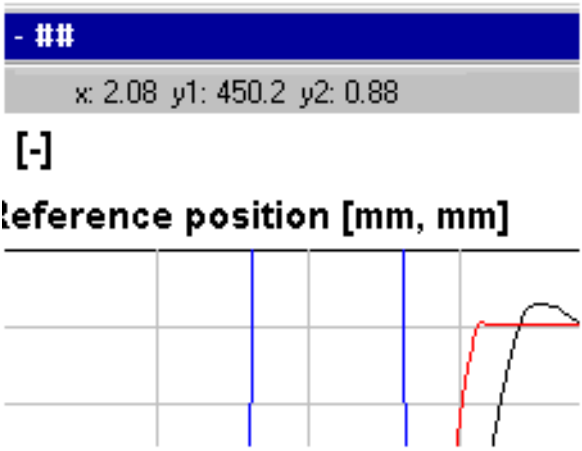


Fig. 6/25: Co-ordinate display

Data cursor

You can display a data cursor if you only want to relate the co-ordinate to the determined measurement values when measuring a graph with the mouse.

Select [Data cursor] from the [Graphic] menu or click on the “Display data cursor in the current graph” or “... switch off ”. buttons to show or conceal a data cursor.

The co-ordinate display relates only to the curve named in the co-ordinate display.

1 Data cursor

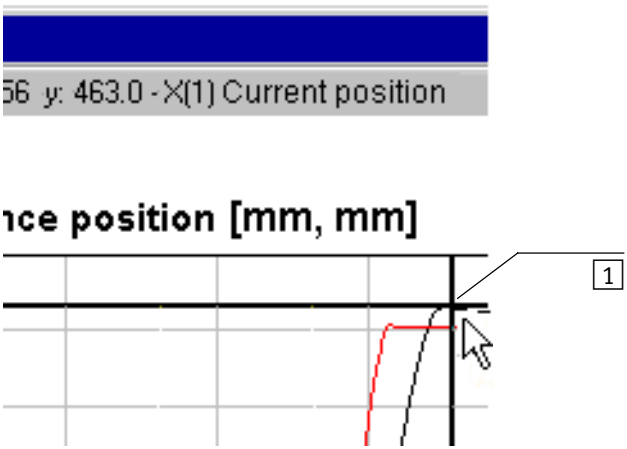


Fig. 6/26: Data cursor

The data cursor appears as cross-hairs in the graph. It is always on the curve measurement value closest to the mouse pointer.

Select [Data cursor on next curve] from the [Graphic] menu to set the data cursor to the next curve.

Reference cursor

If you use a data cursor, you can set a reference cursor to measure differential values. When you do this the difference between the reference cursor and the data cursor is determined in the co-ordinate display.

Please note
The position of the data cursor moves when you move the mouse pointer. You must therefore set the reference cursor either by selecting the menu command from the keyboard or by using the context menu (right-hand mouse button).

To set a reference cursor, move the data cursor to the measurement value to which you want to relate. Then select [Set reference cursor] from the [Graphic] menu.

Once you have set a reference cursor, co-ordinates relative to the reference cursor will be displayed for the data cursor, in addition to absolute co-ordinates. The relative co-ordinates can be recognised by the letter “d” in front of the axis identifier.

1 Reference cursor

2 Data cursor

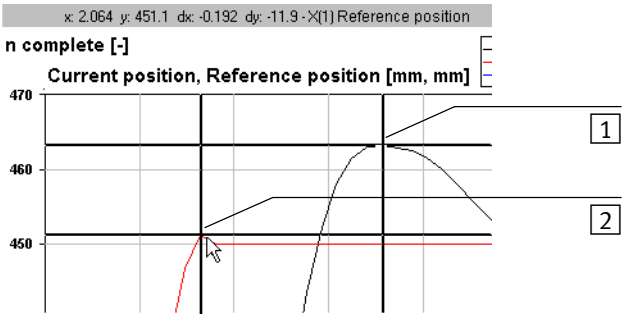


Fig. 6/27: Reference cursor

Select [Reset reference cursor] from the [Graphic] menu to remove a reference cursor.

Example

You wish to determine both the time for a positioning process and the extent of overswing on a single axis system. Measurement recording has been implemented for the positioning process. A graph has been created from the “Current position”, “Reference position” and “Motion Complete” variables.

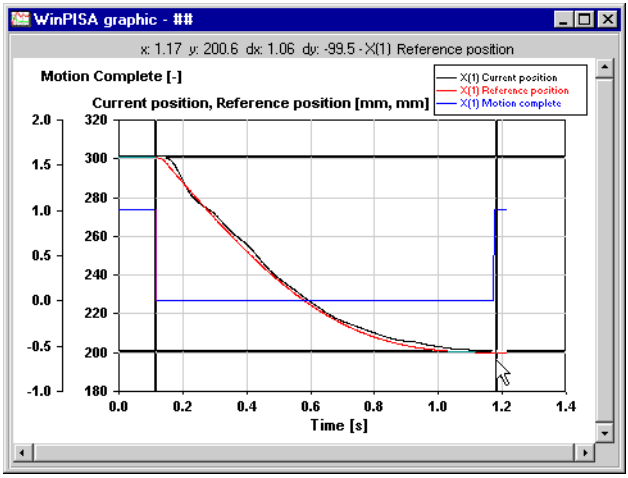


Fig. 6/28: Example for a single axis system

To determine the positioning time:

1. Activate the data cursor and set it to the “Current position” curve.
2. Set the data cursor to the start of the positioning movement. To do this, you can use the “Motion Complete” curve as a guide.
3. Set the reference cursor to this position.
4. Move the data cursor to the position at which the “Current position” curve is stable at the “Reference position” curve. Here, too, you can use the “Motion Complete” curve as a guide.
5. Read the value for “dx” from the co-ordinate display. This is the time required for the positioning process in seconds.

6.6.6 User-defined graphs

If you frequently have to create the same graph for different measurements, you can define it as a “user-defined graph”.

The following settings in the graph will then be saved:

– database

– axis attributes

– curve attributes.

If you call a user-defined graph, a new graph with the settings defined under “Data base” will be created on the basis of the current measured values.

User-defined graphs always refer to the number of the tab under “Existing measurement data” in the “Data base” dialogue window. User-defined graphs referring to tab “[0]” are always based on the current Online measurement data. Graphs referring to tab “[1]” are based on the measurement value file first opened, etc.

1. Make sure that the graphic window is the active window.
2. Select [Establish as user def. graphic] from the [Graphic] menu.
3. Enter a name for the user-defined graph in the “New menu entry” field of the “User-defined graphic” dialogue window.
4. Click “OK” to confirm your entry.

The user-defined graph is now saved and will be shown in the [Graphic] [User defined] menu.

To open a user-defined graphic:

1. Make sure that the measurement values on which the user-defined graph is based are loaded. If necessary, you can check this in the “Data base” dia-logue box (see [Graphic] menu, command [New]) or you can open the measurement value file required.

2. Select the name of the user-defined graph from the [Graphic] [User defined] menu.

A new graphic window will open showing the user-defined graph.

To edit the entries for user-defined graphics:

1. Select [Edit] from the [Graphic] [User defined] menu.

2. Select the entry you wish to edit from “Existing menu entries” in the “User-defined graphic” dialogue window.

3. You can edit in one of the following ways:

   – Click on “Delete” to remove the entry selected.

   – Change the name of the user-defined graph in the “New menu entry” field and click “Modify” to accept the change.

4. Click “OK” to confirm your entry.

The changes to the entries for user-defined graphs are now saved and are shown in the [Graphic] [User defined] menu.

6.7 Optimizing the positioning behaviour

When the axis and application parameters as well as the system identification and adaption have been entered, the closed loop controller of the SPC200 will be automatically set so that optimum positioning behaviour is achieved. If, however, optimization is still required, you will find the necessary information in this section.

6.7.1 Basic information on control

The basis for controlling the pneumatic axis is a model positioning path in the SPC200. This model assumes that there is a pneumatic axis set up according to specifications, e.g. in respect of:

- the supply of compressed air
- the valve-cylinder combination used
- the permitted mass load
- the size and length of the tubing, etc.

The basis parameters of this positioning path are:

- the axis and application parameters to be entered
- internal data calculated by the system identification and by adaption.

System identifikation

During commissioning, variables such as speed, acceleration ability, friction and valve characteristics of the axis are ascertained by the system identification.

Adaption

With adaption, the positioning behaviour is continuously monitored during operation. Internal control data are thereby adapted to the actual status of the axis, e.g. in order to compensate for system wear or suchlike during service life.

The SPC200 enables not only point to point positioning (G00), but also profile control (G01, G02) of the pneumatic axes.

Point-to-point

With point-to-point positioning, the SPC200 generates reference values for path, speed and acceleration. This should enable reproducible, as fast as possible and no-overswing movement to the reference position (see section 5.5, command G00).

Profile control

With profile control, the reference values are calculated on the basis of the reference values for position, speed and acceleration programmed by the user (see section 5.5, commands G01, G02).

The nominal positioning time is the sum of the individual times for the following phases:

– acceleration phase
– braking phase
– smooth movement phase.

Please note that the programmed speed and accelera-tion values are automatically limited to realistic values depending on the positioning stroke. The maximum values which can be implemented are calculated individually for each axis during dynamic identification.

6.7.2 Description of the controller factors

The SPC200 calculates various controller parameters from the basis parameters. These controller parameters determine the dynamics (speed) as well as the transfer behaviour (damping) of the control. The aim is to guarantee fast no-overswing positioning with few contour errors (dynamic controlling deviation).

The controller parameters calculated by the SPC200 are therefore normally the optimum values. The (real) pneumatic axes used do not, however, always correspond to the (ideal) axes used as a basis for control. In order to account for any possible deviations, you can influence the control parameters by entering factors.

Instructions on optimizing the positioning behaviour can be found in section 6.7.4.

The factors are standarized to 1.0 by the SPC200. By increasing the factors > 1), you can correspondingly increase the parameters; by decreasing the factors (< 1), you can correspondingly decrease the parameters.

Gain factor

With the gain factor you can influence the sensitivity with which the closed-loop positioning reacts to the modifications to the “measured variables” (position, speed, acceleration).

Behaviour of axis	**Factor**
The drive tends to instability (tendency to oscillate when positioning, up to continuous oscillation around the reference position).	Decrease
Bad positioning accuracy or too many contour errors as well as long positioning time.	Increase
The positioning procedure is carried out quickly and accurately.	Optimum

Permitted: 0.1 ... 10.0

Damping factor

Damping is a measure of the transfer behaviour of the system from the actual to the reference status, especially with fast reference value modifications. The system should normally guarantee low overswing behaviour with reference value specifications and no-overswing movement to the end position.

By modifying the factor for damping, you can influence the transfer behaviour of the system.

Behaviour of axis	Factor
Bad positioning quality, reference position is only reached slowly (underswing).	Decrease
The drive tends to instability (tendency to oscillate when positioning, up to continuous oscillation around the reference position, heavy overswing).	Increase
The positioning procedure is carried out quickly and accurately.	Optimum

Permitted: 0.1 ... 10.0

Signal filter factor

Speed and acceleration are derived from the path signal and filtered to improve the signal quality. If the signal quality is bad, e.g. as a result of electrical interference, the filtering of the signal can be influenced by the signal filter factor.

If filtering is too strong, it may destabilize the positioning control.

Behaviour of axis	Factor
The drive tends to instability (in spite of low gain and good damping).	Decrease
“Noise” or loud valve sounds (observe if gain is perhaps too strong).	Increase
The positioning procedure is carried out quickly and accurately, low valve sounds.	Optimum

Permitted: 0.1 ... 10.0

6.7.3 Judging the positioning behaviour

WinPISA supports you in judging the positioning process by recording measured values. You can represent these values in the form of a graph with the aid of the graphic functions of WinPISA in order to evaluate them.

Proceed as follows in order to judge the positioning behaviour of an axis:

1. Observe the positioning behaviour of the axis. Ascertain the positioning step for which the positioning behaviour is possibly not satisfactory.
2. Trace the measurement values of this positioning step with the command [Control axes] in the [Online] menu in Debug mode. Save the values for later comparison.
3. Create a graph using the recorded measured values with the command [New] in the [Graphic] menu.

Use the zoom function when displaying the graph or modify the scaling of the corresponding axis with the command [Modify axis attributes] in the [Graphic] menu. In this way you can show more clearly the appropriate areas of the graph.

Instructions on evaluating certain measured variables

Set the reference position and the current position as a factor of time. If necessary, you can add other measured variables.

Final reference position

By a jump in the final reference position you can recognize the point in time at which the axis receives a positioning order.

Motion complete	Use the variable motion complete to determine the end of a positioning procedure. You can then determine the exact point in time when an axis is ready to accept the next positioning task.
Controller output signal	With the aid of the standardized controller output signal you can recognize the extent to which the valve is controlled. If, during the positioning movement, the controller output signal remains for a period at -1 or +1. this is a sign that the axis has reached the limits of its performance. In this case, program a lower speed or accele-ration or reduce the maximum defined speed or maxi-mum acceleration in the application parameters.
Speed	By means of the speed, you can recognize whether and in which direction the axis moves. This will make it easier for you to identify standing times (speed = 0) as well as underswing or overswing (sign change in speed = change in direction of movement).

6.7.4 Optimizing the positioning behaviour

The following problems may arise during positioning:

– the axis stops prematurely several times

– swinging around the reference position

– stability problem, highly frequent oscillation around the reference position

– overswing

– underswing.

Before trying to optimize the positioning behaviour of the axis, proceed as follows:

- Make sure that the pneumatic axis is set up according to the specifications (see system manual for the SPC200).
- Make sure that all axis and application parameters are set correctly.
- Always carry out the static identification and at least one of the dynamic system identifications.
- Then carry out several positioning cycles. This is to guarantee that the adaption is effective.

If, however, problems still occur, proceed as follows:

1. Observe the positioning behaviour. Trace the measurement values of the relevant positioning steps with the command [Control axis] in the [Online] menu in Debug mode. Create a graph on the basis of the recorded measured values as described in section 6.7.3.
2. Compare the graph with the following examples.
3. In order to optimize the positioning behaviour, proceed as described in the appropriate example. Observe the sequence in the list of causes and their relevant remedial measures. First check the probable causes and their remedial measures from top to bottom.

Axis stops several times prematurely

1 Final reference position

2 Current position

3 Standing times

4 Speed = 0

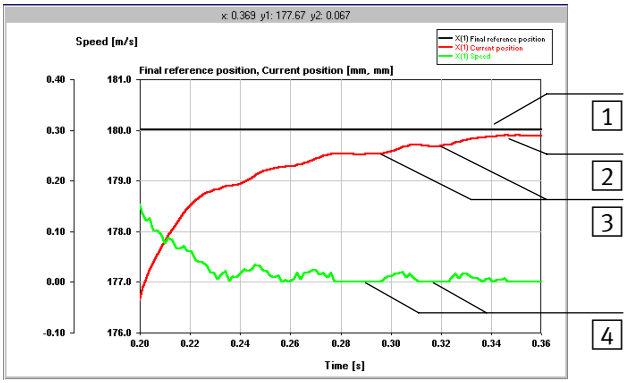


Fig. 6/29: Axis stops several times prematurely

Causes	Remedy
– System identification not carried out	• Carry out system identification
– Adaption not completed	• Move a few positioning cycles
– Cylinder/guide runs badly (stick-slip)	• Carry out test or maintenance or replace components
– Incorrect mass	• Correct configuration
– Incorrect valve type configured	• Correct configuration

Swinging around the reference position with standing times

1 Current position

2 Final reference position

3 Standing times (Speed = 0)

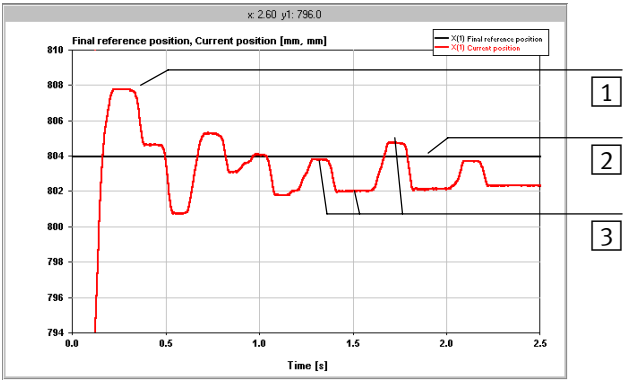


Fig. 6/30: Swinging around the reference position with standing times

Causes	Remedy
– Static identification not carried out	• Carry out static identification
– Incorrect mass load configured or programmed (M37)	• Correct configuration or program
– Cylinder completed a lomg period in service (friction has changed)	• Carry out system identification again (static or dynamic)
– Gain factor set too low	• Correct the parameter

Stability problem, highly frequent oscillation around the reference position

1 Final reference position

2 Current position

3 Speed

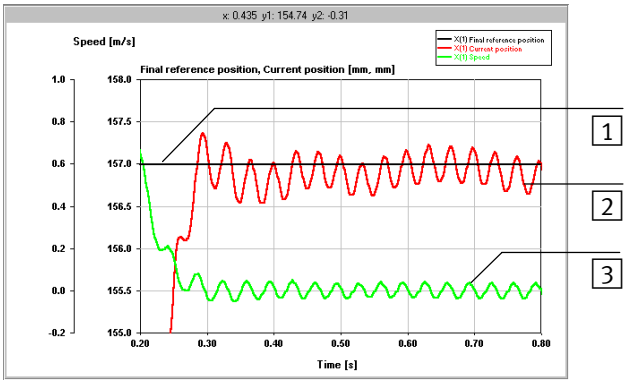


Fig. 6/31: Stability problem

Causes	Remedy
– Incorrect mass load configured or programmed (M37)	• Correct configuration or program
– Gain factor set too high	• Correct the parameter
– Damping factor set too low	• Correct the parameter
– Signal filter factor set too high (smoth acceleration/speed signal but continuous oszillation)	• Reduce signal filter factor
– Or very noisy acceleration signal with high amplitude	• Increase signal filter factor
– Minimum mass load exceeded	• Increase basic load (see system manual for the SPC200)
– Insufficient tolerance required	• Increase tolerance

Overswing (no or minimum standing time before MC)

1 Final reference position

2 Current position

3 Overswing (sign change of the speed when final reference position is reached)

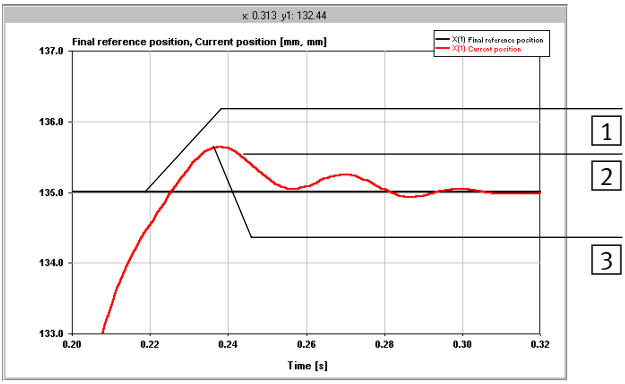


Fig. 6/32: Overswing

Causes	Remedy
– Reduction of the static supply pressure in operation below the permitted tolerance limit	• Stabilize the supply pressure or indentify with low supply pressure (see section 6.7.5)
– Mass load too high (or configured mass load too low)	• Correct mass
– Overstressing (nominal acceleration too high)	• Reduce nominal values (esp. acceleration). If necessary, carry out dynamic identification travel (automatic limiting)
– Signal filter factor set too high	• Correct the parameter
– Gain factor set too high	• Correct the parameter
– Damping factor set too low	• Correct the parameter

Underswing (no or minimum standing time before MC)

1 Final reference position

2 Current position

3 Underswing (sign change of the speed before final reference position is reached)

4 Speed change

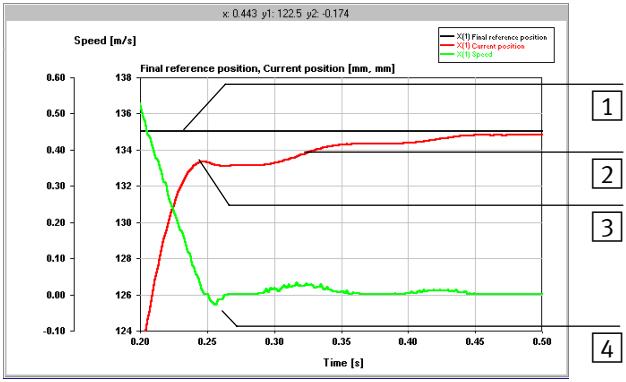


Fig. 6/33: Underswing

Causes	Remedy
– Mass load entered too high (under circumstances causes over-cushioned controller)	• Reduce mass load (see system manual for the SPC200)
– Demand too high (“fast” reference values too high)	• Adapt reference values, if necessary, carry out dynamic identification (automatic limitation)

6.7.5 Procedure in the event of an instable compressed air supply

If your compressed air supply does not fulfil the requirements reliably (tolerance of ± 1 bar in operation), although a compressed air reservoir has already been installed (see system manual for the SPC200), the maximum values for acceleration and slowing down, which were calculated during identification, may not be reached under certain circumstances.

This could result in overswing if the operating pressure required for slowing down is not available.

In order to prevent such overstressing, the dynamics of the system must be reduced. To do this proceed as follows:

1. Ascertain the lowest static supply pressure available for positioning in your compressed air network.
2. Lower the supply pressure statically to this amount.
3. Now carry out the dynamic identification again.
4. When identification is completed, raise the supply pressure again to the value set in the application parameters.

6.8 Error treatment

WinPISA has a number of different functions available for diagnosing and rectifying errors in the SPC200:

– error messages from the SPC200 are evaluated and displayed as text

– programs can be reset by a Program reset for a defined new start

– the SPC200 can be reset to the starting status using a system reset if it has entered an undefined status due to incorrect entries or program errors.

Error messages

WinPISA checks all Online functions to see whether the SPC200 is issuing an error message. The error messages from the SPC200 consist of an 8-digit hexadecimal number. WinPISA supplements these error messages with a descriptive text clearly indicating the cause of the error.

Further information on the error messages can be found in the system manual for the SPC200.

The current error and the errors in the error stack are shown in the window “Status display” under the tab “Error”.

If a error is displayed in WinPISA, quit the message window with “OK”. You will then be asked if the fault is to be deleted. With “Yes” the errors displayed on the SPC200 will be deleted with a few exceptions. Check and eliminate the cause of the fault before continuing work with the SPC200. The last 15 faults which have occurred remain in the fault stock until they are deleted there or until the SPC200 is switched off.

Program reset

The user programs can be reset through I/O signals or through a menu command (Program reset).

With a program reset:

- the NC record pointer is reset to 0
- the pre-settings G90 and G02 (speed factor, acceleration factor and mass load factor 100 %) as well as the positioning quality class set in the application data become valid
- the analogue channel will be switched off (M12)
- all settings undertaken with M10, M11, M13 or M14 are reset to the defined standard values (parameter set for the axis, tab card “Analogue nominal value”)
- pre-switch off values defined with G25 will be reset
- direct control of the valve voltage (M39) will be deactivated
- all settings undertaken with M40 and M41 will be reset to the standard values
- all freely programmable outputs and the SYNC outputs will be reset
- the set starting programs are made available
- any errors are quitted.

Control signals required:
1-signal at ENABLE.

Please note
If there is no 1-signal at ENABLE, there will not be a program reset. No error message will be displayed.

To execute a program reset with WinPISA:

1. Select [Online mode] from the [Online] menu or click on the button “Online mode on” in the toolbar to activate Online mode.
2. Select [Program reset] from the [Online] [Commissioning] menu.
3. Read the warning displayed. Click “Continue” to execute the program reset; click “Cancel” to cancel the function.

To execute a program reset using I/O signals (see following diagram):

1. Apply 0-signal to inputs STOP and START.
2. Execute a program reset by a rising edge to START input.

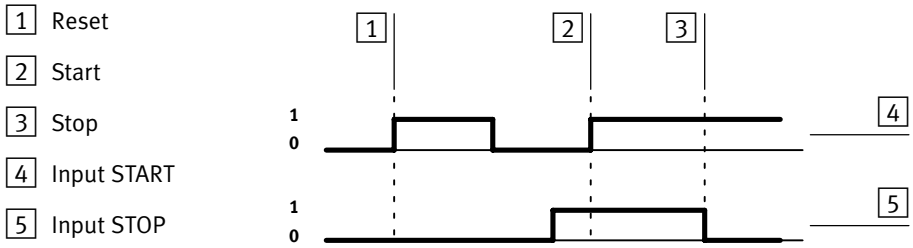


Fig. 6/34: Program control using I/O signals

System reset

By means of a menu command, the SPC200 can be reset to the status which existed after it was switched on (System reset).

A program reset and a hardware recognition are carried out here. The axis interface string is then reinitialized. This procedure can take a certain amount of time depending on the configuration.

Please note
A system reset automatically occurs with the following actions:

- Project download with fieldbus module
- Changing the hardware configuration,
- Only for fieldbus:
  Changing the start program, changing fieldbus configuration.

When the system is reset, the axis status flag REF (reference set) is cleared and has to be referenced again; see G74.

To execute a system reset with WinPISA:

1. Select [Online mode] from the [Online] menu or click on the “Online mode on” button in the toolbar to activate Online mode.
2. Select [System reset] from the [Online] [Commissioning] menu.
3. Read the warning displayed. Click “Continue” to execute the system reset; click “Cancel” to cancel the function.

Data reset

The SPC200 can be reset to the status as at delivery by a menu command (data reset).

A data reset is always necessary after a modification to the axis assignment. This is carried out automatically by WinPISA after interrogation.

During the switching-on phase, the SPC200 assigns axis identifiers to the connected axes. If modifications are made to the axis configuration at a later stage, there will be a new assignment of the axis identifiers. As a result, all user data already entered, such as parameters, programs, position list as well as the identification and adaption parameters ascertained by the SPC200, will be invalid.

Caution
During a data reset, all data entered will be reset to the status as at delivery or deleted.

Make sure that you save the desired data in a WinPISA project (upload), so that you can load them, if necessary, into the SPC200.

You can carry out a data reset with WinPISA as follows:

1. Select [Online mode] from the [Online] menu or click on the “Online mode on” button in the toolbar to activate Online mode.
2. Select the command [Data reset] in the menu [Online] [Commission].
3. Read the warning displayed. You can carry out the data reset with “Continue”; you can terminate the function with “Cancel”.

After the data reset a rising edge is required at the ENABLE input for enabling the controller.

Working with the keyboard

Appendix A

Contents

A.1 Key assignment A-3

A.1 Key assignment

WinPISA can be completely operated using the keyboard. A wide variety of keys and key combinations are available for you to do this.

System keys

The following keys can be used from a window or full screen display, whichever application you are using.

Press key(s) ...	... to do the following:
CTRL+ESC	Switch to the task list.
ALT+ESC	Move to the next application, no matter whether it is running as a window or an icon.
ALT+TAB	Move to the previous application or further. Hold down the ALT key and press the TAB key repeatedly.
PRINT key	Copies an image of the screen to the clipboard.
ALT+PRINT	Copies an image of the active window to the clipboard.
ALT+SPACEBAR	Opens the system menu in an application window.ALT+SPACEBAR
ALT+HYPHEN	Opens the system menu in a document window.
ALT+F4	Ends the application or closes a window.
CTRL+F4	Closes the active group or document window.
ALT+ENTER	Toggles execution of a non-Windows application between a window and a full screen display.
An ARROW key	Moves a window when you have selected the [Move] command from the system menu. Or it changes the size of a window when you have selected the [Resize] command from the system menu.

Menu keys

Press key(s) ...	... to do the following
ALT key or F10	Selects or unselects the first menu in the menu bar.
A character key	Selects the menu or the command with the underlined letter or number corresponding to the key pressed.
LEFT ARROW key or RIGHT ARROW key	Moves between menus.
UP key or DOWN key	Moves between commands.
ENTER key	Selects the marked menu name or command.
ESC key	Unselects the selected menu, or closes the open menu.

Edit keys

Use the following keys to edit text in a dialogue field or window.

Press key(s) ...	... to do the following
BACKSPACE	Deletes the character to the left of the insertion point, or deletes the selected text.
DELETE key	Deletes the character to the right of the insertion point, or deletes the selected text.
SHIFT+DELETE or CTRL + X	Deletes the selected text and places it on the clipboard.
SHIFT+INSERT or CTRL + V	Inserts the text from the clipboard into the active window.
CTRL+INSERT or CTRL + C	Copies the selected text and places it on the clipboard.

Dialogue window keys

Use the following keys in the dialogue window.

Press key(s) ...	... to do the following
TAB key	To move from one element to another (from right to left, and from top to bottom).
SHIFT+TAB	To move from one element to the previous one.
CTRL+ALT+TAB	To go to the next element group.
ALT+character key	To go to the option or group containing the underlined letter or number given by you.
An ARROW key	Moves the cursor within an option group from one option to another, or to the next register when a register is selected. Or moves the cursor to the left, to the right, up or down within a list or text field.
HOME key	Moves to the first element or character within a list or text field.
END key	Moves to the last element or character within a list or text field.
PAGE UP key	Moves up through a list screen by screen.
PAGE DOWN key	Moves down through a list screen by screen.
ALT+DOWN	Opens a list.
SPACEBAR	Selects an element in a list or cancels the selection. Activates or de-activates a check box.
CTRL+HASH (#)	Selects all elements in a list box.
CTRL+CARET (^)	Removes all selections other than the current one.
SHIFT+one ARROW key	Expands or removes a selection in a text field, character by character.
SHIFT+HOME	Expands or removes the selection in a text field up to the first character.
SHIFT+END	Expands or removes the selection in a text field up to the last character.
ENTER key	Carries out a command.

Cursor keys

Use the following keys to move the cursor or the insertion point within a text field and within other positions in which you can enter text.

Press key(s) ...	... to do the following
UP key	Moves one line up.
DOWN key	Moves one line down.
RIGHT ARROW key	One character to the right.
LEFT ARROW key	One character to the left.
CTRL+RIGHT ARROW	One word to the right.
CTRL+LEFT ARROW	One word to the left.
HOME key	To the start of the line.
END key	To the end of the line.
PAGE UP key	Moves one screen up.
PAGE DOWN key	Moves one screen down.
CTRL+HOME	To the start of the text.
CTRL+END	To the end of the text.

Make sure that NUM LOCK is switched off if you wish to use the numeric keypad for orientation functions.

Text selection keys

The following keys can be used in most Windows applications.

The following text selection operations use the position of the insertion point as a starting point. Moving the insertion point will unselect text that has already been selected.

Press key(s) ...	... to select the following or to remove selection
SHIFT+RIGHT ARROW	To the right character by character.
SHIFT+LEFT ARROW	To the left character by character.
SHIFT+UP	Up one line.
SHIFT+DOWN	Down one line.
SHIFT+PAGE UP	The whole text, one page up.
SHIFT+PAGE DOWN	The whole text, one page down.
SHIFT+HOME	The text up to the start of the line.
SHIFT+END	The text up to the end of the line.
CTRL+SHIFT +LEFT ARROW	The previous word.
CTRL+SHIFT +RIGHT ARROW	The next word.
CTRL+SHIFT+HOME	The text up to the start of the document.
CTRL+SHIFT+END	The text up to the end of the document.

Keyboard

The key descriptions refer to an English keyboard. If you have a German keyboard, you can convert the keys as follows:

German	English	Meaning
EINGABE	ENTER	The enter key is the same in WinPISA as (new line)
UMSCHALT	SHIFT	Shift key (⇧)
ENTF	DELETE	Delete key
EINFG	INSERT	Insert key
STRG	CTRL	Control key
POS1	HOME	To the start of the line
ENDE	END	To the end of the line
BILD NACH-OBEN	PAGE UP	Screen page up
BILD NACH-UNTEN	PAGE DOWN	Screen page down
RÜCKTASTE	BACKSPACE	Delete character left of insert mark (cursor)

Troubleshooting

Appendix B

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B.1 Possible problems in positioning

Possible problems	Cause	Remedy	Remarks
The slide moves into end position	The control direction is not the same as the direction of movement of the slide	Swap the connectingtubing on the proportional directional control valve	See also system manual for the SPC200
	Measuring system or measuring system cable defective	Replace measuring system or measuring system cable	First check with Movement test
The slide oscillates around a position	The axis/application parameters are not correct	Correct parameters	See section 4.3
An error message is shown in Online mode	See error message	Rectify error	See also SPC200 User Manual
The slide does not move	Valve cable is defective	Check the cable	
	No compressed air supply	Switch on compressed air supply or check tubing	
	The closed loop controller is switched off because there is no ENABLE signal	Apply 1-signal to input ENABLE	
	The system has stopped	Apply 1-signal to input STOP	
	The proportional directional control valve is defective	Replace the proportional directional control valve	First check with movement test

B.2 Error messages

In Online mode the error messages by the SPC200 are displayed in a message window which you must quit with “OK”.

You will then be asked if the error is to be deleted.
With “Yes” the errors displayed on the SPC200 will be deleted with a few exceptions. Check and eliminate the cause of the error before continuing work with the SPC200. However, the error remains in the error stack until it is deleted there or until the SPC200 is switched off.

The error messages consist of an 8-figure hexadecimal number which is evaluated by WinPISA and shown in clear text.

Further information on the error messages can be found in the system manual for the SPC200.

B.3 Firmware-Download

The SPC200 can be adapted to future developments such as new cylinder types, measurement systems etc.

To take this into account, you are offered the possibility of replacing the “operating system” of the SPC200 by a later version.

This can be carried out with the commands in the [Online] [Download] [Firmware] menu.

This commands are intended only for the use of Festo service personnel.

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